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**DATA PROCESSING PLAN  
FOR ECCENTRIC  
ORBITING GEOPHYSICAL OBSERVATORY  
(OGO-B)**

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DATA PROCESSING PLAN  
FOR  
ECCENTRIC ORBITING GEOPHYSICAL OBSERVATORY  
(OGO-B)

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DATA PROCESSING PLAN  
FOR  
ECCENTRIC ORBITING GEOPHYSICAL OBSERVATORY  
(OGO-B)

SECTION I. SPACECRAFT OPERATION

THE MISSION

The OGO-B spacecraft, depicted in Figure 1, will carry into a highly eccentric orbit about the earth, a large number of varied geophysical experiments. A greater understanding of the earth, and of earth-sun relationships will be obtained from these.

As the third mission of the OGO program, the OGO-B will be launched by an Atlas-Agena B vehicle from the Atlantic Missile Range and injected into an eccentric orbit of approximately 31 degrees inclination. The spacecraft weighs about 1000 pounds, of which 150 pounds are allocated for the experiments. The orbit has a nominal perigee of 150 nautical miles, a nominal apogee of 80,000 nautical miles, and a period of 63.3 hours. The orbit allows the OGO-B to traverse the radiation belts twice during each orbit and to make geophysical measurements from the region near the earth to cislunar space. A mission lifetime of one year is expected.

THE SPACECRAFT

OGO-B is a rectangular aluminum-panelled box weighing approximately 1000 pounds, a weight which includes a minimum total experiment weight of 150 pounds. Two solar arrays and their Solar Orbital Experimental Package (SOEP), an Orbital Plane Experiment Package (OPEP), six experiment booms and three antennas constitute the major appendages of the spacecraft.

In its fully deployed and operational configuration, OGO-B will utilize reaction wheels and gas jets to maintain an attitude with respect to the sun, earth and orbital plane such that its solar paddles (Figure 4) are normal to the sun-spacecraft line, the +Z door is normal to the earth-spacecraft line, and the Orbital Plane Experiment package looks into the orbital plane in the direction of the velocity vector. The OGO Coordinate system is further illustrated in Figure 5.

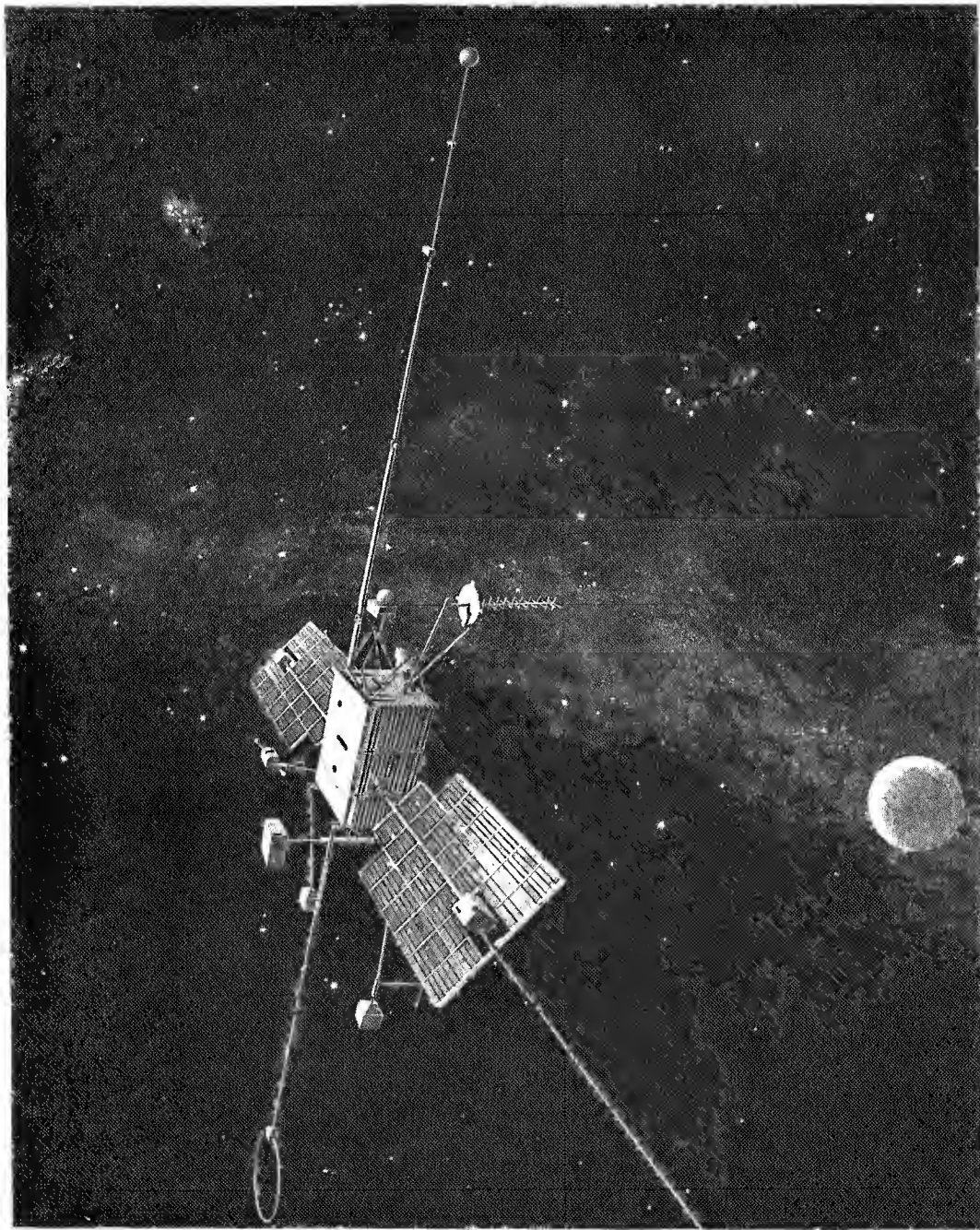


Figure 1—OGO Spacecraft



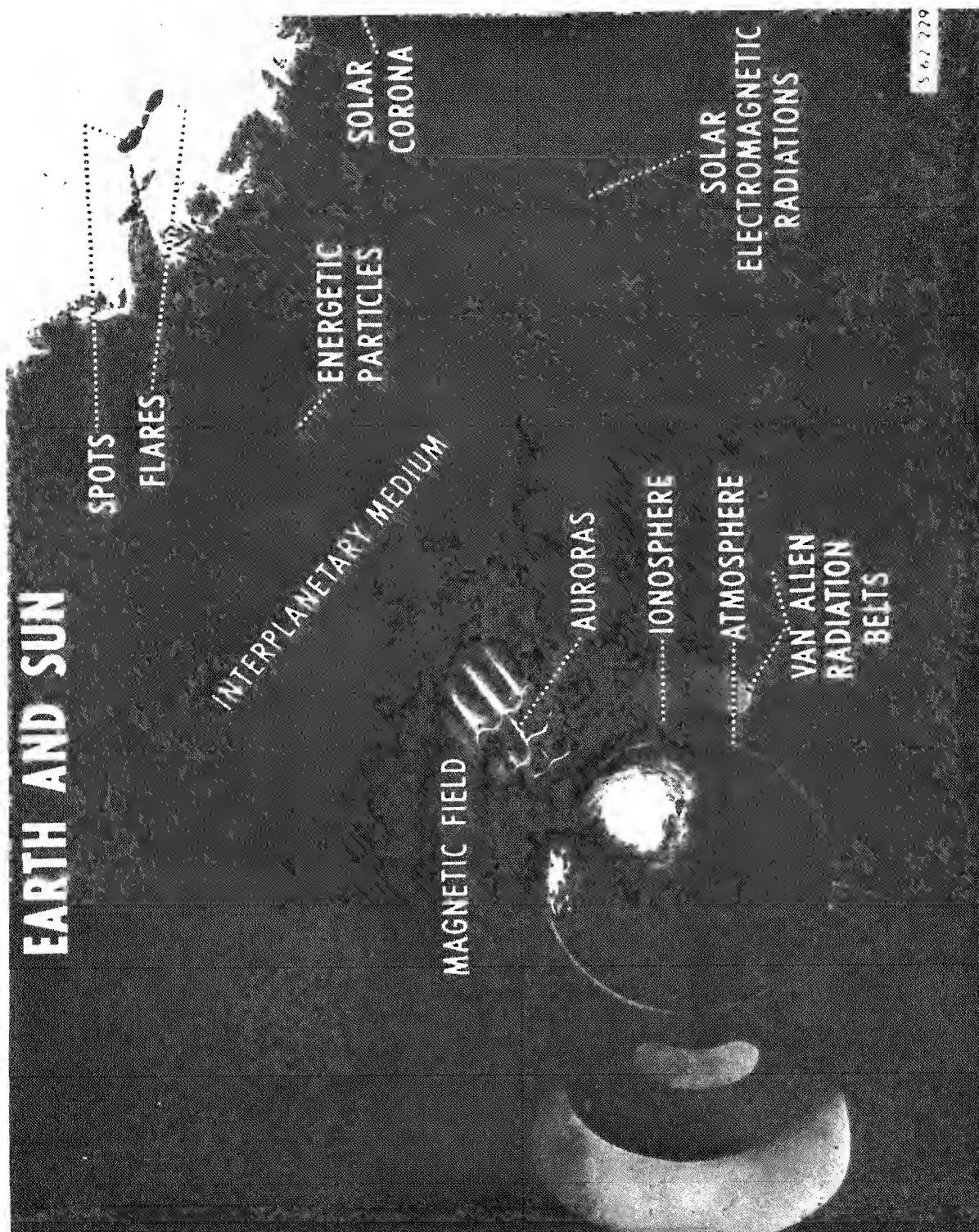


Figure 2—Earth Sun Relationship



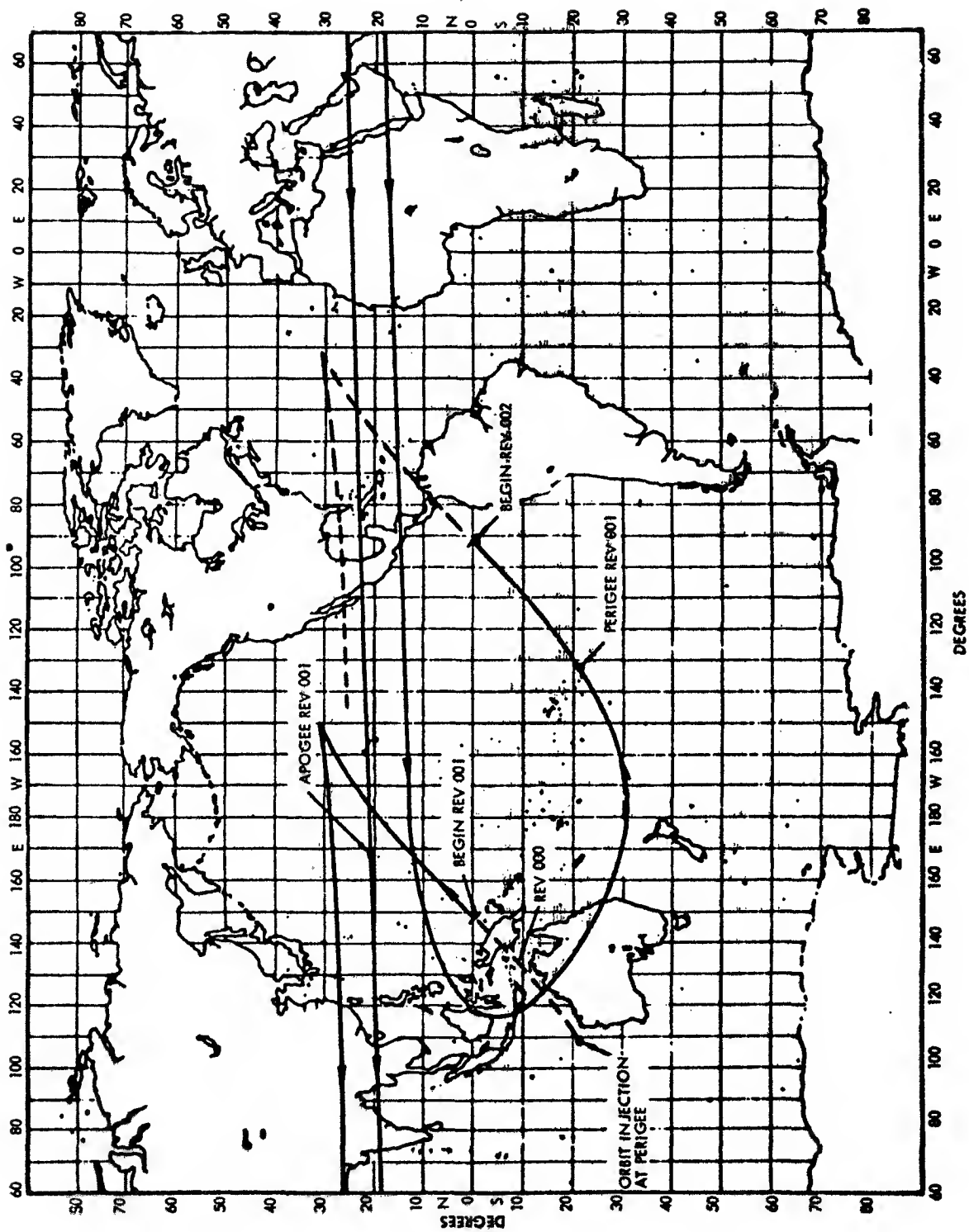


Figure 3—Orbital Subsatellite Plot—First Revolution



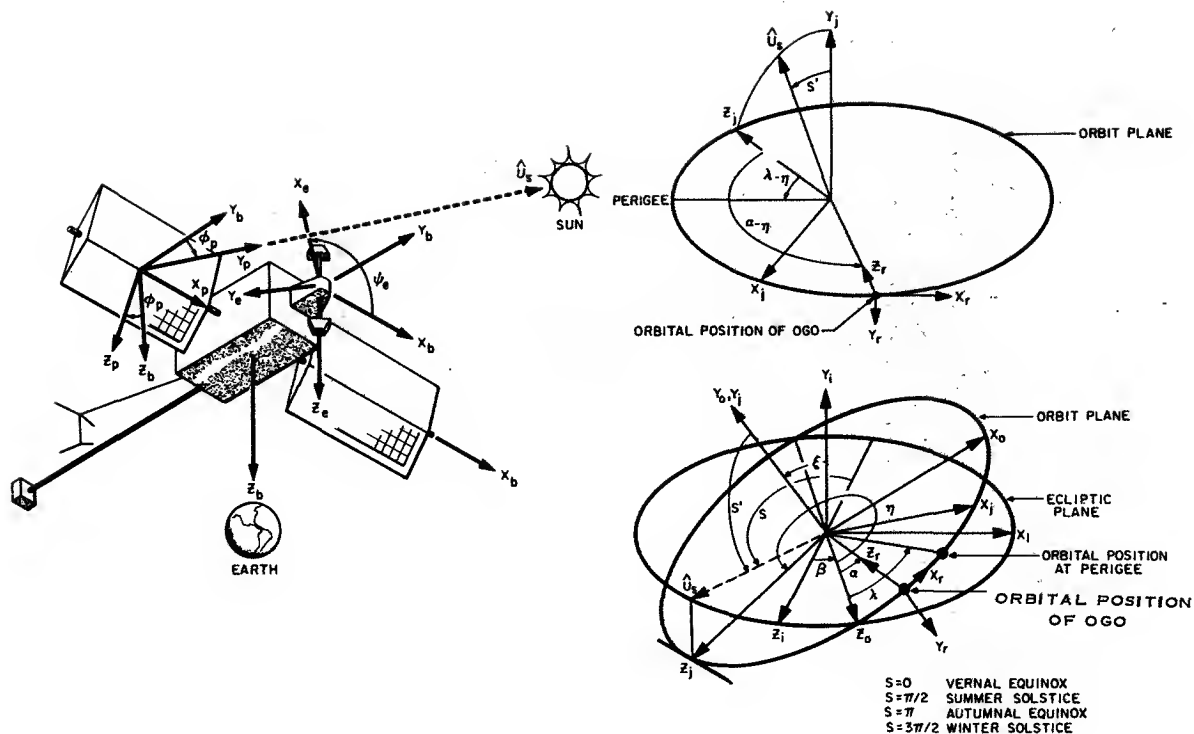


Figure 5-OGO Coordinate System

## THE EXPERIMENTS

OGO-B will carry 20 experiments. Their general description and the cognizant scientist for each are listed in the table of Figure 6. Their location on the spacecraft is given in Figure 7.

## SPACECRAFT TELEMETRY AND DATA-HANDLING

### PCM Telemetry

OGO-B uses a split-phase PCM/PM digital telemetry system, in which each telemetry word contains 9 bits.

Exp. No.	Experimenter	Affiliation	Experiment
4901	Anderson	Univ. of Calif.	Solar Protons
4902	Wolfe	Ames Research Center	Plasma Protons (Electrostatic Analyzer)
4903	Bridge	M. I. T.	Plasma Protons & Electrons (Faraday Cup)
4904	Cline	GSFC	Positrons and Gamma Rays
4905	Davis & Konradi	GSFC	Trapped Radiation (Scintillation Counter)
4906	McDonald & Ludwig	GSFC	Cosmic Ray Isotopic Abundance
4907	Simpson	Univ. of Chicago	Cosmic Ray Spectra & Fluxes
4908	Van Allen	State Univ. of Iowa	Trapped Radiation (Geiger Counters)
4909	Winkler	Univ. of Minnesota	Electron Spectra & Total Ionization
4910	Smith	JPL	Low Frequency Magnetic Field Variations
	Holzer	UCLA	
4911	Heppner	GSFC	Magnetic Field Measurements
4912	Sagalyn	AFCRL	Thermal Charged Particles
4913	Whipple	GSFC	Thermal Charged Particles
4914	Lawrence	NBS	Electron Density by RF Propagation
4915	Taylor	GSFC	Atmospheric Composition (1-45 AMU)
4916	Alexander	GSFC	Micron Dust Particles
4917	Helliwell	Stanford Univ.	VLF Noise & Propagation
4918	Haddock	Univ. of Michigan	Radio Astronomy
4919	Mange	USNRL	Geocoronal Lyman-Alpha Scattering
4920	Wolff	GSFC	Gegenschein Photometry

Figure 6--Summary of OGO-B Experiments

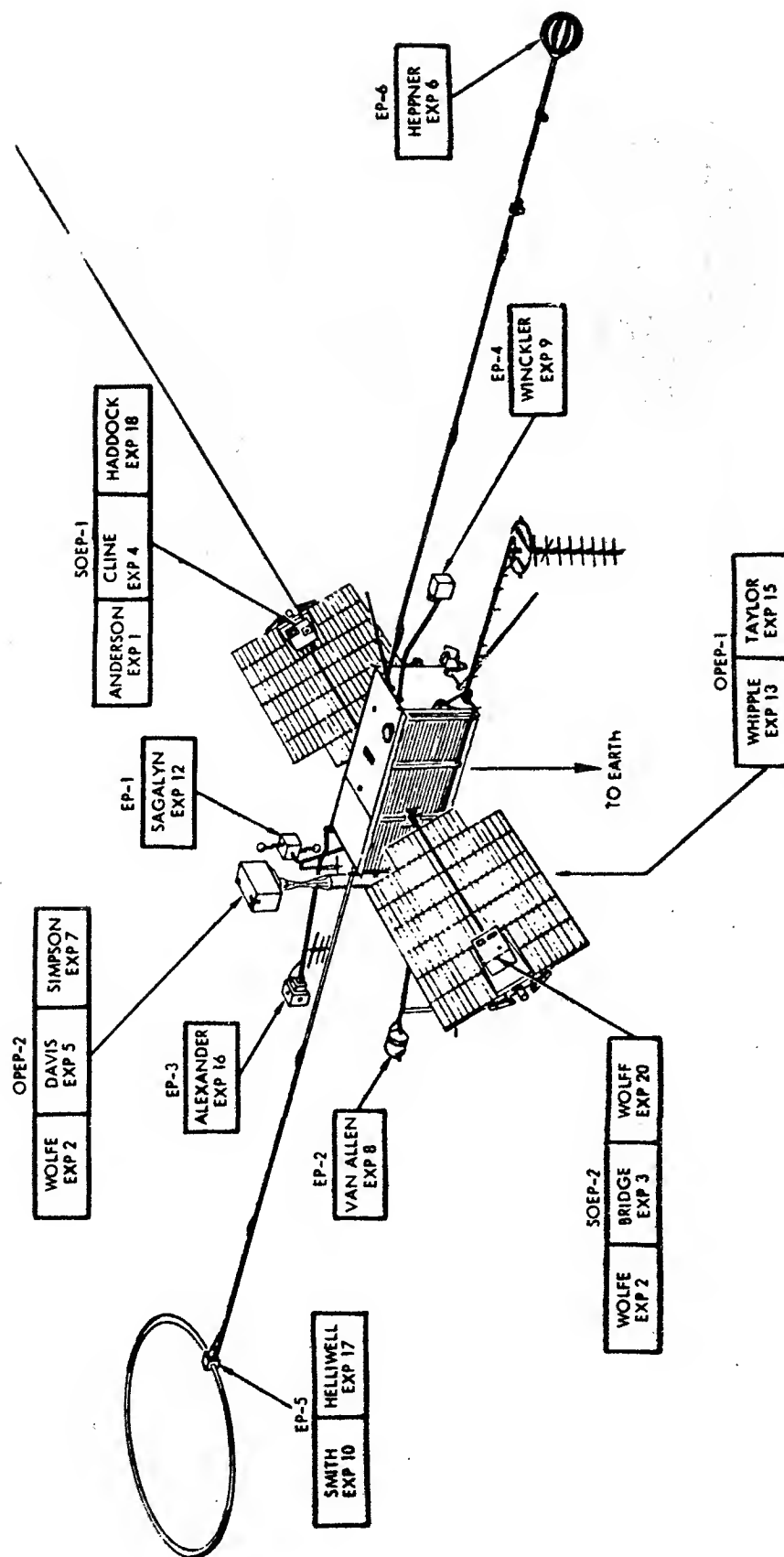


Figure 7-Experiment Mounting Locations

# SPACECRAFT AND EXPERIMENT THERMISTOR LOCATION OGO-B

## LEGEND

SPACECRAFT THERMISTORS  
△ BASE PLATE MOUNT    △ COMPONENT MOUNT

- |                      |                      |
|----------------------|----------------------|
| 1. E1: SC3-1/600     | 28. A33: SC3-98/741  |
| 2. E2: SC3-2/601     | 29. A34: SC3-97/740  |
| 3. E28: SC3-82/675   | 30. F17: SC3-86/723  |
| 4. F18: SC3-87/700   | 31. F19: SC3-88/720  |
| 5. F20: SC3-89/721   | 32. F21: SC3-90/722  |
| 6. A26: SC3-100/744  | 33. E16: SC3-24/627  |
| 7. E21: SC3-36/645   | 34. E25: SC3-58/645  |
| 8. E7: SC3-7/606     | 35. F14: SC2-88/541  |
| 9. E8: SC3-8/607     | 36. F20: SC3-87/726  |
| 10. A32: SC3-99/742  | 37. E5: SC3-3/604    |
| 11. E24: SC3-59/646  | 38. F15: SC3-99/542  |
| 12. O50: SC3-68/703  | 39. F22: SC3-88/727  |
| 13. O51: SC3-69/704  | 40. O11: SC3-66/701  |
| 14. E27: SC3-48/635  | 41. O12: SC3-67/702  |
| 15. E2: SC3-7/706    | 42. E6: SC3-6/605    |
| 16. C4: SC3-103/746  | 43. E13: SC3-13/608  |
| 17. C1: SC3-70/705   | 44. A8: SC3-104/747  |
| 18. E15: SC3-23/626  | 45. E22: SC3-37/644  |
| 19. E13: SC3-21/624  | 46. F18: SC3-84/725  |
| 20. E17: SC3-14/615  | 47. F18: SC3-85/724  |
| 21. E20: SC3-55/642  | 48. E5: SC3-3/602    |
| 22. A30: SC3-100/745 | 49. E4: SC3-4/603    |
| 23. A37: SC3-53/640  | 50. E26: SC3-30/635  |
| 24. E19: SC3-54/641  | 51. E23: SC3-40/647  |
| 25. E14: SC3-22/625  | 52. O4: SC3-20/625   |
| 26. E13: SC3-21/624  | 53. A25: SC3-102/745 |
| 27. A3: SC2-6/605    |                      |

## EXPERIMENT THERMISTORS

- SOEP 1, EXP 15, PRE-AMP, SCI-78/105
  - 2 DOOR, EXP 6, SCINTILLATOR ASSY, SCI-EG-150/18
  - 2 DOOR, EXP 7, COMPOSITION TELESCOPE, SCI-18/186
  - 2 DOOR, EXP 7, PROTON-ALPHA TELESCOPE, SCI-120/167
  - DOOR, EXP 15, ELECTROMETERS, SCI-84/123
  - OPREP 1, EXP 15, ELECTROMETER, SCI-85/123
  - OPREP 1, EXP 15, ANTIFIELD MANIFOLD, SCI-85/123
  - OPREP 1, EXP 15, ELECT ASSY, SCI-EBI-59/034
  - OPREP 2 (UNCALIB), SCI-12/015
  - EXP 2, EXP 6, ELECTRONIC PACKAGE, SCI-44/085
  - 2 DOOR, EXP 5, ELECTRONIC PACKAGE, SCI-36/044, 107/155
  - 2 DOOR, EXP 5, ELECTRONIC PACKAGE, SCI-36/044, 107/155
  - EXP 3, EXP 3, PROTON EXP, MIC-10/012, 42/052, 74/112, 108/182
- (the 67th step in exp data set of 69 steps)  
ELECTRONIC PACKAGE.

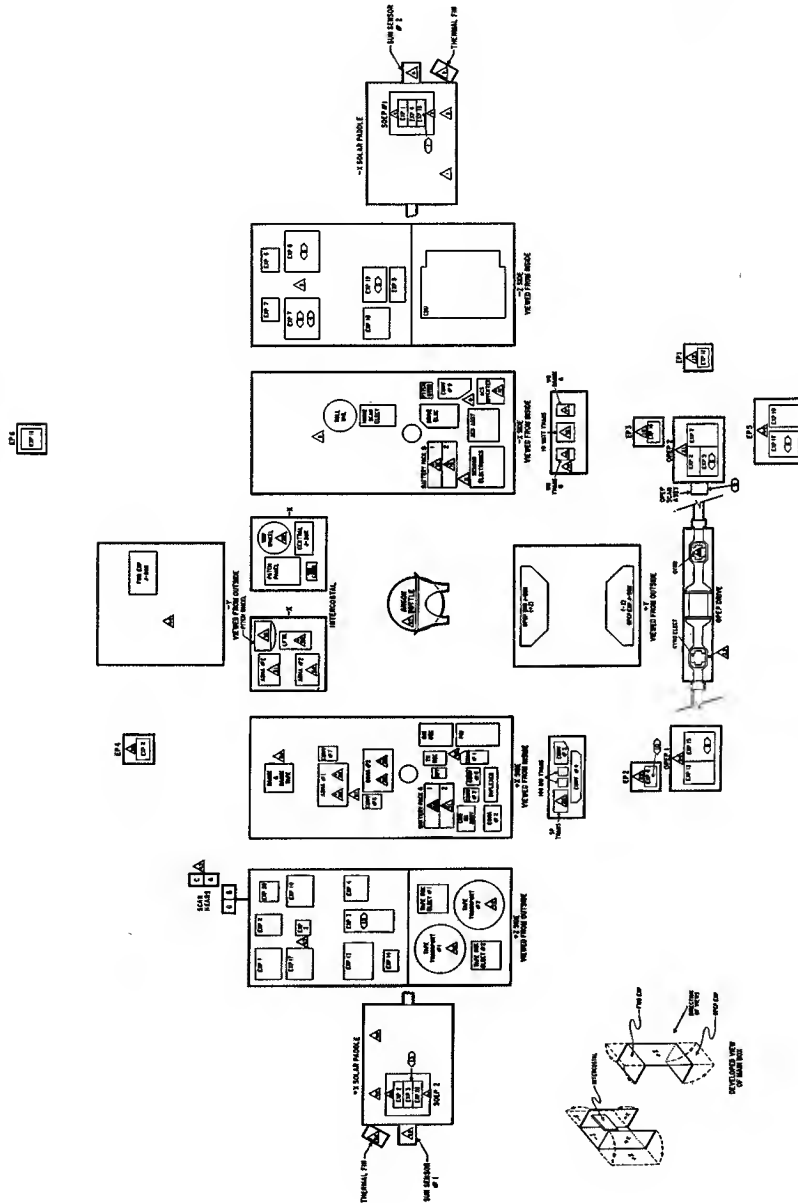


Figure 7A—Spacecraft and Experiment Thermistor Location, OGO-B

## PARTICIPATING EXPERIMENTERS

### INTRODUCTION

The primary objective of the Observatory is the successful fulfillment of the scientific mission as defined by the objectives of the experiments. The highly elliptical OGO-B orbit allows the Observatory to traverse the radiation belts and to make a series of geophysical measurements from the region near the earth and through the magnetosphere to interplanetary space. The payload consists of 20 experiments designed for the study of charged particles, measurement of magnetic fields, and observation of various ionospheric and radio-astronomical phenomena.

### EXPERIMENTS

A brief description of scientific objectives and detection devices of each of the twenty experiments is presented in the following paragraphs. Included is the principal experimenter and his affiliation. The experiment numbers shown were arbitrarily assigned during the initial phases of the program purely for identification and convenience in referencing and in no way indicate priority or relative importance.

#### Solar Protons (Experiment No. 1)

Dr. K. A. Anderson  
University of California  
Berkeley, California

The primary objective of this experiment is to measure the energy spectrum and intensity of solar protons with energies between 2 Mev and 100 Mev. A measure of the spatial inhomogeneities and time variations of the solar proton flux and fluxes attributable to solar flares will also be obtained. The sensor is a solar oriented scintillation counter. Both the pulse height output of the counter, which is a measure of the energy of impinging protons absorbed in the scintillation crystal, and the pulse count are monitored by the telemetry.

#### Plasma Protons (Electrostatic Analyzer) (Experiment No. 2)

Dr. J. H. Wolfe  
Ames Research Center  
Moffett Field, California



This experiment measures the flux and energy spectrum of protons in the energy range from 100 ev to 20 Kev. Three electrostatic analyzers are utilized, with two oriented into the orbital plane and one solar oriented. Each analyzer consists of two closely spaced hemispherical conducting plates which, when charged, exert a coulomb force on charged particles between the plates. Thus, only particles with the correct charge to mass ratio and energy for a given electric field are admitted to a collector after deflection by the plates. A differential energy spectrum is obtained by varying the electric field. Further, the solar oriented analyzer is equipped with deflection plates and four electrometer tubes in such a manner as to provide information concerning the direction of the incoming flux relative to the sun-vehicle line and local magnetic field line.

#### Plasma Protons and Electrons (Faraday Cup) (Experiment No. 3)

Dr. H. J. Bridge  
Massachusetts Institute of Technology  
Cambridge, Massachusetts

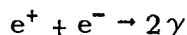
This experiment consists of two separate but closely related experiments designed to measure plasma properties, with primary concern directed to properties, of the interplanetary medium and the earth's magnetosphere. Plasma proton flux, energy spectrum from 10 ev to 10 Kev, and direction are measured by the Faraday Cup oriented along the satellite-sun vector. A Faraday Cup contains several grids biased with a stepping voltage to allow only particles of the correct sign and with energy greater than the retarding potential to impinge on a collector. Direction is determined by the relative outputs of three collectors arranged within the cup. Plasma electron flux and the energy spectrum within the range 25 ev to 2 Kev are measured by a Faraday cup mounted on the spacecraft earth facing door. Additional scientific objectives include measurements of the temporal and spatial variations of the above quantities and correlation of all data with magnetic field measurements.

#### Positron Search and Gamma Rays (Experiment No. 4)

Dr. T. L. Cline  
Goddard Space Flight Center  
Greenbelt, Maryland

This experiment will investigate the possible existence of low-energy positrons trapped in a permanent or transitory manner in the radiation belts, and the possible arrival of low-energy solar or interplanetary positrons at the edge

of the magnetosphere. Also, the flux and spectrum of solar gamma rays will be measured. Instrumentation consists of a multiple scintillation counter-photo-multiplier tube device oriented toward the sun. Positrons are detected by the coincidence- and anti-coincidence logic of the detector system in the detection of gamma rays produced by the positron annihilation reaction:



#### Trapped Radiation (Scintillation Counter) (Experiment No. 5)

Mr. L. R. Davis & A. Konradi  
Goddard Space Flight Center  
Greenbelt, Maryland

A study of geomagnetically trapped electrons and protons will be provided by this experiment. Specifically, the directional intensity of protons, the directional energy flux of electrons, and the absorption curves of these particles will be determined by an ion-electron phosphor scintillation detector located behind a stepping variable absorption wheel. The detector is mounted in an orbital plane experiment package and upon ground command can scan  $\pm 110$  degrees relative to the spacecraft velocity vector. This scanning technique allows the particle pitch angle distribution to be measured directly. Studies of the above parameters should provide further clarification of such problems as particle lifetimes and the processes by which trapped particles are lost.

#### Isotopic Abundance and Galactic Cosmic Rays (Experiment No. 6)

Dr. F. B. McDonald and Dr. G. H. Ludwig  
Goddard Space Flight Center  
Greenbelt, Maryland

This experiment utilizes two separate sensing devices: a  $dE/dX$  vs.  $E$  scintillation telescope for isotopic abundance measurements and a Geiger counter triaxial telescope. The primary objectives are to measure the flux, charge, and energy of primary cosmic radiation. The  $dE/dX$  vs.  $E$  scintillation counter provides a knowledge of the energy of a particle and its rate of energy loss, which enables the particle to be identified. Two major objectives are (1) a determination of the amount of interstellar material through which primary cosmic rays have passed, and (2) a study of the various forms of modulation of hydrogen and helium nuclei. The triaxial telescope is designed primarily as a monitor of the background cosmic ray intensity above the earth's atmosphere. A secondary objective is the study of the charge and energy spectra of cosmic rays produced by the sun.

### Cosmic Ray Spectra and Fluxes (Experiment No. 7)

Dr. J. A. Simpson  
University of Chicago  
Chicago, Illinois

The scientific objectives of this experiment are to measure the intensity and energy distribution of high energy cosmic rays in the range 0.3 Mev to 4 Bev/nucleon. The origin of galactic cosmic rays, acceleration mechanisms, and radiation modulation from interplanetary magnetic fields are of primary interest. In addition to protons and alpha particles, measurements will also be made of the heavier cosmic ray constituents, such as lithium, beryllium, boron and oxygen. Detection is provided by a  $dE/dX$  vs.  $E$  scintillation device, solid-state detectors, and PM tubes mechanized so as to provide information defining the charge, mass, and energy of the particles as well as the acceptance angle.

### Trapped Radiation (Geiger Counters) (Experiment No. 8)

Dr. J. A. Van Allen  
State University of Iowa  
Iowa City, Iowa

The objectives of this experiment are to study the absolute intensity and energy spectrum of geomagnetically trapped electrons and protons in the energy range from 40 Kev to 3 Mev as a function of position and time. This study is a continuing effort to improve the observational foundations for understanding the dynamics of the trapped particles and their relationship to aurorae, magnetic storms and ionospheric perturbations. While the Observatory is near apogee, a study of the passage of energetic particles through interplanetary space will also be provided. The experiment detector is comprised of one omnidirectional Geiger tube and six Geiger tubes mounted in groups of three on mutually perpendicular axes. Thus, in addition to energy measurements, directionality is also provided by noting the difference in count rates from identically shielded tubes.

### Electron Spectra and Total Ionization (Experiment No. 9)

Dr. J. R. Winckler  
University of Minnesota  
Minneapolis, Minnesota

An electron spectrometer is utilized by this experiment to measure the electron energy spectra in the 50 Kev to 4 Mev range in the Van Allen radiation

zone. The electrometer is a swept field magnetic spectrograph with a scintillator-photomultiplier arrangement constituting the electron detector. Simultaneously, an ionization chamber measures the intensity of the total ionizing radiation. The experiment assists in the study of the injection, trapping, and loss mechanisms acting in the earth's radiation belts.

#### Low Frequency Magnetic Field Variations (Experiment No. 10)

Dr. E. J. Smith  
Jet Propulsion Laboratory  
Pasadena, California

Dr. R. E. Holzer  
University of California  
Los Angeles, California

The scientific objectives of this experiment are to investigate the nature of extremely low-frequency (0.01 cps to 3 kc) fluctuations in the terrestrial geomagnetic field, in the interplanetary field, the interface, and to investigate the relationship between the observed fluctuations in these three regions of space and the simultaneous variations at the earth's surface. Sufficient data may be obtained to furnish information relative to trapped particle acceleration mechanisms and hydromagnetic wave propagation. The magnetometer is composed of three search coils mounted mutually orthogonally and situated at the end of one of the spacecraft long booms. On an attitude-stabilized spacecraft such as OGO-B, this type of magnetometer is insensitive to fixed (dc) magnetic fields.

#### Magnetic Field Strength and Direction (Experiment No. 11)

Dr. J. P. Heppner  
Goddard Space Flight Center  
Greenbelt, Maryland

A combination of component flux-gate sensors and a rubidium-vapor magnetometer is employed to provide comprehensive magnetic field measurements. The objectives are to accurately measure the interaction of solar and geomagnetic field phenomena, to measure the local field sources such as ring currents, to study the rapid field fluctuations with frequency ranges covering at least four orders of magnitude, and to provide charts and mathematical descriptions for the International World Magnetic Field Survey. The flux-gate sensors are triaxially mounted to measure both the sense and magnitude of the ambient magnetic field within a range of  $\pm 500$  gamma. The rubidium-vapor magnetometer is a duo dual-cell system with an output frequency proportional to the magnitude of the magnetic field. The range of the vapor magnetometer is from approximately 3 gamma to 0.14 gauss. The experiment is located on one of the long booms.

Thermal Charged Particles (Experiment No. 12)

Dr. R. C. Sagalyn  
Air Force Cambridge Research Laboratory  
Bedford, Massachusetts

The purpose of this experiment is to measure the flux and energy distributions of electrons and positive ions in the thermal energy range of 0.2 ev to 1 Kev. Further, the spacecraft potential with respect to the undisturbed plasma field will be measured. A spherical electron trap and a spherical ion trap, both of which are mesh balls surrounding collectors, are the sensing devices. Sweeping and stepping potentials are applied to the periphery of the balls to establish retarding potentials and thus analyze the energy of particles reaching the collectors.

Thermal Charged Particles (Experiment No. 13)

Dr. E. C. Whipple  
Goddard Space Flight Center  
Greenbelt, Maryland

The objectives of this experiment are to obtain the densities and energy distributions of both negative and positive ions in the low energy or thermal ranges throughout the Observatory orbit. In addition to densities and temperatures, ion masses and the flux and directions of quasi-energetic particle beams will also be measured. From analysis of the above parameters, the polarity and magnitude of the spacecraft potential will be obtained. The sensor is oriented into the Observatory orbital plane and consists of a planar ion trap which separates particles according to their polarity and energy by a retarding potential technique.

Electron Density by RF Propagation (Experiment No. 14)

Mr. R. S. Lawrence  
National Bureau of Standards  
Boulder, Colorado

This experiment measures the electron density along the propagation path of signals transmitted from the Observatory to ground stations. The Doppler shift and Faraday rotation of two coherent frequencies (40 and 360 Mc) transmitted from the Observatory are measured by ground stations situated around the earth. Both frequencies are phase modulated by 20 kc and 200 kc sine waves.

#### Atmospheric Composition (1-45 AMU) (Experiment No. 15)

Mr. H. A. Taylor  
Goddard Space Flight Center  
Greenbelt, Maryland

The objective of this experiment is to measure the positive ion composition between one and 45 atomic mass units throughout the Observatory orbit. The instruments used are Bennett r-f mass spectrometers oriented into the orbital plane. This type of spectrometer utilizes retarding a-c and d-c fields to exclude ions not satisfying the velocity and phase conditions established by the fields from reaching an ion detector. Resolution is 1 AMU. To provide greater sensitivity, two separate spectrometers are used, one sensitive to 1-6 AMU ions and the other to 7-45 AMU ions.

#### Micron Dust Particles (Experiment No. 16)

Mr. W. M. Alexander  
Goddard Space Flight Center  
Greenbelt, Maryland

The objective of this experiment is to measure the mass, velocity, directionality, intensity, and time and spatial variations in the micrometeorite flux throughout the Observatory orbit. Four similar sensors accept particles from four different directions relative to the Observatory coordinate system. A plasma cloud/clocking/microphonic sensor arrangement yields the desired parameters.

#### VLF Noise and Propagation (Experiment No. 17)

Dr. R. A. Helliwell  
Stanford University  
Stanford, California

This experiment will increase the overall understanding of the VLF phenomena in the earth's magnetosphere. The phenomena to be studied include the terrestrial noise produced from such atmospheric phenomena as lightning noise, VLF emissions produced by solar particles and of general extraterrestrial origin, and the propagation of VLF signals from low frequency ground stations. A 0.2 to 100 kc receiver with a circular antenna erected in orbit provides the Observatory instrumentation. Much of the data will be compared with ground observations.

### Radio Astronomy (Experiment No. 18)

Dr. F. T. Haddock  
University of Michigan  
Ann Arbor, Michigan

The prime objective of this experiment is to investigate the dynamic radio spectrum of solar and jovian (Jupiter) radio-noise bursts and galactic emissions. The investigations cover the frequency range from 2 to 4 Mc by a receiver with automatic repetitive tuning. The primary time of interest is the first few minutes subsequent to a solar flare. During this time, the frequency drift rate, bandwidth, and duration of the fastdrift solar bursts will be observed.

### Geocoronal Lyman-Alpha Scattering (Experiment No. 19)

Dr. P. W. Mange  
Naval Research Laboratory  
Washington, D. C.

The objective of this experiment is to measure the intensity of Lyman-alpha radiation (1216A) and locate the scattering layer. This wavelength is the fundamental resonance line of neutral hydrogen and could therefore provide a measure of the neutral hydrogen density in the interplanetary medium. Instrumentation consists of four ion chambers sensitive to the Lyman-alpha wavelength. The chambers are mounted on the anti-earth side of the Observatory.

### Gegenschein Photometry (Experiment No. 20)

Dr. C. L. Wolff  
Goddard Space Flight Center  
Greenbelt, Maryland

A scanning image dissector is employed by this experiment to obtain images of the sky in the antisolar direction. The Gegenschein (counterglow) originates from back-scattered sunlight from particles in space. Some information relative to the nature of the scattering medium, such as whether gas or dust and whether the medium is collective or dispersed, will also be obtained.

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Bit rates in use during real-time transmissions will be 64, 8 or 1 kilobits per second. On-board tape-recorders will record data at 1 kilobit per second. Playback of tape-recorded data will be at a transmission rate of 64 kilobits per second.



EGO carries two redundant Equipment Groups for data handling, termed EG1 and EG2. Normally EG1 will handle data for real-time transmission and EG2 will handle data being recorded on-board the spacecraft. Their functions can be switched upon command from the ground if required. As in some cases with OGO-A, if a specific data format is in use with EG1, that same data format may experience a change in telemetry channel assignments when used with EG2.

One frame of telemetry data will consist of 128 9-bit words. Twelve words of the frame will contain as fixed inputs: the frame sync pattern, the spacecraft clock readout, spacecraft data handling status words, and sampling of the three spacecraft subcommutators. Assignment of data outputs to the remaining words of the 128-word frame will vary in format according to whether the outputs are supplied in the spacecraft Main Frame mode, in one of the 32 Flexible Format modes or in the Accelerated Subcommutator Mode. The Main Frame commutator assigns outputs to the 128-word frame from all experiments except 4914 which does not use the S/C PCM data format. Selection of one of the Flexible Format modes, made by ground command only, will replace Main Frame assignments and assign outputs from the spacecraft subcommutators to the 128-word frame. Selection of a flexible format for assigning outputs to the 128-word frame in effect results in super-commutation of subcomm outputs in the main frame. Selection of the Accelerated Subcommutator mode, obtained by ground command, will assign subsystem outputs from spacecraft subcommutator #2 (Channel 98) to the 116 non-fixed words of the frame. The format for the Main Frame mode is given as Figures 8 and 9. The format corresponding to the Accelerated Subsystems commutator is the same as that given in Figure 18 for spacecraft subcommutator #2 with the exception that channels 97, 98, 99 become "frozen" to a constant and that words 1-3, 33-35, and 65-67, respectively contain the normally fixed inputs of frame sync, spacecraft clock, and data-handling status.

Recording of data onto the on-board tape recorders may occur simultaneously with real time transmissions. Data is recorded on tape recorders 1 & 2, normally under control of Equipment Group 2. Recording takes place at a rate of 1 kilobit per second and play back at a rate of 64 kilobits per second. When recording at the 1 kilobit rate, one tape recorder will become full in 12 hours. Recording onto the next recorder will begin automatically. Upon ground command real time transmissions will be interrupted, tape recorders automatically dumped, and an automatic return made to simultaneous recording and real time transmission. Tape recorded data will be played back to ground acquisition stations in a reversed time sequence with tape recorder #1 dumped first and playing the data out in a direction opposite to that in which recording took place, being immediately followed by tape recorder #2. (While tape recorder #1 is being played back, tape recorder #2 continues to record. It is therefore possible to obtain continuous data coverage for the lifetime of the S/C.)

**HORIZONTAL**

A THE 2<sup>ND</sup> BIT IS A 2<sup>ND</sup> UPDATE--

Figure 8--Main Telemetry Format EG 1

# OGO-B MAIN TELEMETRY FORMAT EQUIPMENT GROUP 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	000	2	001	3	002	4	003	5	004	6	005	7	006	8	007	9
11	000	2	001	3	002	4	003	5	004	6	005	7	006	8	007	9
20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
33	040	34	041	35	042	36	043	37	044	38	045	39	046	40	047	41
49	060	50	061	51	062	52	063	53	064	54	065	55	066	56	067	57
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
65	100	66	101	67	102	68	103	69	104	70	105	71	106	72	107	73
81	120	82	121	83	122	84	123	85	124	86	125	87	126	88	127	89
97	140	98	141	99	142	100	143	101	144	102	145	103	146	104	147	105
113	160	114	161	115	162	116	163	117	164	118	165	119	166	120	167	121
129	180	130	181	131	182	132	183	133	184	134	185	135	186	136	187	137
145	200	146	201	147	202	148	203	149	204	150	205	151	206	152	207	153
161	220	162	221	163	222	164	223	165	224	166	225	167	226	168	227	169
177	240	178	241	179	242	180	243	181	244	182	245	183	246	184	247	185
193	260	194	261	195	262	196	263	197	264	198	265	199	266	200	267	201
209	280	210	281	211	282	212	283	213	284	214	285	215	286	216	287	217
225	300	226	301	227	302	228	303	229	304	230	305	231	306	232	307	233
241	320	242	321	243	322	244	323	245	324	246	325	247	326	248	327	249
257	340	258	341	259	342	260	343	261	344	262	345	263	346	264	347	265
273	360	274	361	275	362	276	363	277	364	278	365	279	366	280	367	281
289	380	290	381	291	382	292	383	293	384	294	385	295	386	296	387	297
305	400	306	401	307	402	308	403	309	404	310	405	311	406	312	407	313
321	420	322	421	323	422	324	423	325	424	326	425	327	426	328	427	329
337	440	338	441	339	442	340	443	341	444	342	445	343	446	344	447	345
353	460	354	461	355	462	356	463	357	464	358	465	359	466	360	467	361
369	480	370	481	371	482	372	483	373	484	374	485	375	486	376	487	377
385	500	386	501	387	502	388	503	389	504	390	505	391	506	392	507	393
401	520	402	521	403	522	404	523	405	524	406	525	407	526	408	527	409
417	540	418	541	419	542	420	543	421	544	422	545	423	546	424	547	425
433	560	434	561	435	562	436	563	437	564	438	565	439	566	440	567	441
449	580	450	581	451	582	452	583	453	584	454	585	455	586	456	587	457
465	600	466	601	467	602	468	603	469	604	470	605	471	606	472	607	473
481	620	482	621	483	622	484	623	485	624	486	625	487	626	488	627	489
497	640	498	641	499	642	500	643	501	644	502	645	503	646	504	647	505
513	660	514	661	515	662	516	663	517	664	518	665	519	666	520	667	521
529	680	530	681	531	682	532	683	533	684	534	685	535	686	536	687	537
545	700	546	701	547	702	548	703	549	704	550	705	551	706	552	707	553
561	720	562	721	563	722	564	723	565	724	566	725	567	726	568	727	569
577	740	578	741	579	742	580	743	581	744	582	745	583	746	584	747	585
593	760	594	761	595	762	596	763	597	764	598	765	599	766	600	767	601
609	780	610	781	611	782	612	783	613	784	614	785	615	786	616	787	617
625	800	626	801	627	802	628	803	629	804	630	805	631	806	632	807	633
641	820	642	821	643	822	644	823	645	824	646	825	647	826	648	827	649
657	840	658	841	659	842	660	843	661	844	662	845	663	846	664	847	665
673	860	674	861	675	862	676	863	677	864	678	865	679	866	680	867	681
689	880	690	881	691	882	692	883	693	884	694	885	695	886	696	887	697
705	900	706	901	707	902	708	903	709	904	710	905	711	906	712	907	713
721	920	722	921	723	922	724	923	725	924	726	925	727	926	728	927	729
737	940	738	941	739	942	740	943	741	944	742	945	743	946	744	947	745
753	960	754	961	755	962	756	963	757	964	758	965	759	966	760	967	761
769	980	770	981	771	982	772	983	773	984	774	985	775	986	776	987	777
785	1000	786	1001	787	1002	788	1003	789	1004	790	1005	791	1006	792	1007	793
801	1020	802	1021	803	1022	804	1023	805	1024	806	1025	807	1026	808	1027	809
817	1040	818	1041	819	1042	820	1043	821	1044	822	1045	823	1046	824	1047	825
833	1060	834	1061	835	1062	836	1063	837	1064	838	1065	839	1066	840	1067	841
849	1080	850	1081	851	1082	852	1083	853	1084	854	1085	855	1086	856	1087	857
865	1100	866	1101	867	1102	868	1103	869	1104	870	1105	871	1106	872	1107	873
881	1120	882	1121	883	1122	884	1123	885	1124	886	1125	887	1126	888	1127	889
897	1140	898	1141	899	1142	900	1143	901	1144	902	1145	903	1146	904	1147	905
913	1160	914	1161	915	1162	916	1163	917	1164	918	1165	919	1166	920	1167	921
929	1180	930	1181	931	1182	932	1183	933	1184	934	1185	935	1186	936	1187	937
945	1200	946	1201	947	1202	948	1203	949	1204	950	1205	951	1206	952	1207	953
961	1220	962	1221	963	1222	964	1223	965	1224	966	1225	967	1226	968	1227	969
977	1240	978	1241	979	1242	980	1243	981	1244	982	1245	983	1246	984	1247	985
993	1260	994	1261	995	1262	996	1263	997	1264	998	1265	999	1266	1000	1267	999
1009	1280	1010	1281	1011	1282	1012	1283	1013	1284	1014	1285	1015	1286	1016	1287	1009
1025	1300	1026	1301	1027	1302	1028	1303	1029	1304	1030	1305	1031	1306	1032	1307	1017
1041	1320	1042	1321	1043	1322	1044	1323	1045	1324	1046	1325	1047	1326	1048	1327	1018
1057	1340	1058	1341	1059	1342	1060	1343	1061	1344	1062	1345	1063	1346	1064	1347	1019
1073	1360	1074	1361	1075	1362	1076	1363	1077	1364	1078	1365	1079	1366	1080	1367	1020
1089	1380	1090	1381	1091	1382	1092	1383	1093	1384	1094	1385	1095	1386	1096	1387	1021
1105	1400	1106	1401	1107	1402	1108	1403	1109	1404	1110	1405	1111	1406	1112	1407	1022
1121	1420	1122	1421	1123	1422	1124	1423	1125	1424	1126	1425	1127	1426	1128	1427	1023
1137	1440	1138	1441	1139	1442	1140	1443	1141	1444	1142	1445	1143	1446	1144	1447	1024
1153	1460	1154	1461	1155	1462	1156	1463	1157	1464	1158	1465	1159	1466	1160	1467	1025
1169	1480	1170	1481	1171	1482	1172	1483	1173	1484	1174	1485	1175	1486	1176	1487	1026
1185	1500	1186	1501	1187	1502	1188	1503	1189	1504	1190	1505	1191	1506	1192	1507	1027
1201	1520	1202	1521	1203	1522	1204	1523	1205	1524	1206	1525	1207	1526	1208	1527	1028
1217	1540	1218	1541	1219	1542	1220	1543	1221	1544	1222	1545	1223	1546	1224	1547	1029
1233	1560	1234	1561	1235	1562	1236	1563	1237	1564	1238	1565	1239	1566	1240	1567	1030
1249	1580	1250	1581	1251	1582	1252	1583	1253	1584	1254	1585	1255	1586	1256	1587	1031
1265	1600	1266	1601	1267	1602	1268	1603	1269	1604	1270	1605	1271	1606	1272	1607	1032
1281	1620	1282	1621	1283	1622	1284	1623	1285	1624	1286	1625	1287	1626	1288	1627	1033
1297	1640	1298	1641	1299	1642	1300	1643	1301	1644	1						

# FLEX FORMAT, SUBCOM, AND TELEMETRY WORD TIE-IN

FF GATE NO	TLM WORD	SUBCOM NUMBER AND WORD SLOT	FLEX FORMAT NOS.
1	D10	SC2-47	1 2 4 9 11 13 15 16
2	D10	SC2-47	1 2 4 9 11 15 28 29
3	GROUND		1 4 9 11 14 15 16 28
4	B11	NONE	1 4 9 11 15 28 30 32
5	F40	SC2-10,42,74,106	3 4 10 11 13 15 16 28 32
6	B12	NONE	3 4 10 11 15 28 29 32
7	A7	SC2-41,105	3 4 10 11 14 15 16 28 32
8	A10	SC2-23	3 4 10 11 15 28 30 32
9	A11	SC2-24	5 6 8 9 11 12 13 16 31 32
10	A4	SC2-25,89	5 6 8 9 11 12 29 31 32
11	A5	SC2-26,90	5 8 9 11 12 14 16 31 32
12	B13	NONE	5 8 9 11 12 30 31 32
13	B14	NONE	7 8 10 11 12 13 16 31 32
14	B1	SC3-9,73	7 8 10 11 12 29 31 32
15	A17	SC2-50,114	7 8 10 11 12 14 16 31 32
16	A18	SC2-51,115	7 8 10 11 12 30 31 32
17	A19	SC2-52,116	12 13 15 16 17 18 20 25 27 32
18	A20	SC2-53,116	12 15 17 18 20 25 27 29 32
19	A21	SC2-12,28,44,60,76,92,108,124	12 14 15 16 17 20 25 27 32
20	A22	SC2-13,29,45,61,77,93,109,125	12 15 17 20 25 27 30 32
21	A23	SC2-54,118	12 13 15 16 19 20 26 27 32
22	A24	SC2-55,119	12 15 19 20 26 27 29 32
23	B2	SC3-10,74	12 14 15 16 19 20 26 27 32
24	B3	SC3-11,75	12 15 19 20 26 27 30 32
25	B4	SC3-12,76	13 16 21 22 24 25 27 28 31 32
26	A31	SC2-11,43,75,107	21 22 24 25 27 28 29 31 32
27	B5	SC3-13,77	14 16 21 24 25 27 28 31 32
28	B6	SC3-15,79	21 24 25 27 28 30 31 32
29	B7	SC3-16,80	13 16 23 24 26 27 28 31 32
30	B8	NONE	21 23 24 26 27 28 29 31 32
31	B9	NONE	14 16 23 24 26 27 28 31 32
32	B10	NONE	21 23 24 26 27 28 30 31 32

Figure 10—Flexible Format, Subcomm and Telemetry Word Tie, in

# **FLEX FORMAT WORD LEGEND**

<b>FLEX FORMAT GATE No</b>	
	<div><b>TELEMETRY WORD</b></div> <div><b>WORD DESCRIPTION</b></div>

Figure 11—Flexible Format Word Legend

Each of the 128 words in a frame is classed as "digital" or "analog." The ninth or high-order bit of each analog word will never be used to convey data and will always be telemetered in a zero configuration.

Twelve words of the 128-word frame, as mentioned earlier, contain as a fixed input the continuous reading of the following functions:

Frame Sync Words (Words 1-3) — The frame sync bit pattern appears as Figure 13.

# FLEX FORMAT No. 32

COMMANDS  
RT - 276  
DS - 176

FIXED WORDS			4 <b>B11</b> Deploy Bottle 1 PSIA	5 <b>F40</b> S/C Sep, Deploy, Exp Ord	6 <b>B12</b> Deploy Bottle 2 PSIA	7 <b>A7</b> Scan Heads Track Check	8 <b>A10</b> Yaw Error Signal
9 <b>A11</b> Array Error Signal	10 <b>A4</b> Pitch Error Signal	11 <b>A5</b> Roll Error Signal	12 <b>B13</b> Deploy Bottle 3 PSIA	13 <b>B14</b> Deploy Bottle 4 PSIA	14 <b>B1</b> EP 5, 360 ANT Deploy	15 <b>A17</b> Roll Wheel Tach RPM	16 <b>A18</b> Pitch Wheel Tach RPM
17 <b>A19</b> Yaw Wheel Tach RPM	18 <b>A20</b> Reaction Wheel Directions	19 <b>A21</b> Control Valves 1, 2, 5	20 <b>A22</b> Control Valves 3, 4, 6	21 <b>A23</b> ACS Modes Sun Sensor	22 <b>A24</b> Pitch Rate Gyro Demod	23 <b>B2</b> EP 6 Deploy	24 <b>B3</b> Array 1 Deploy
25 <b>B4</b> S/C Sep, Array 2 Deploy	26 <b>A31</b> Reaction Wheels On-Off	27 <b>B5</b> EP 1, EP 2, EP 3 Deploy	28 <b>B6</b> EP 4, Jets, 136 ANT Deploy	29 <b>B7</b> Hi-Gain ANT, OPEP Deploy	30 <b>B8</b> Pre-Deploy 1	31 <b>B9</b> Pre-Deploy 2	32 <b>B10</b> Pre-Deploy 3

Figure 12-Flexible Format 32

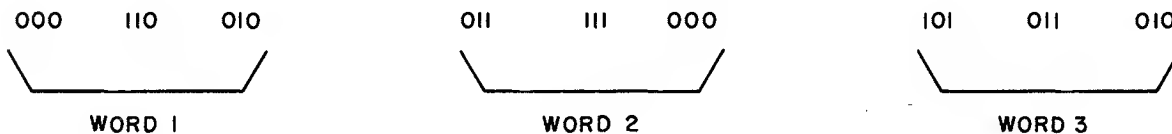


Figure 13-Frame sync word format

SPACECRAFT CLOCK READOUT																	
WORD 33									WORD 34								
1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
f	u	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
i	n	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
a	u																
g	s																
	e																
	d																
																	0

Figure 14-Spacecraft clock format

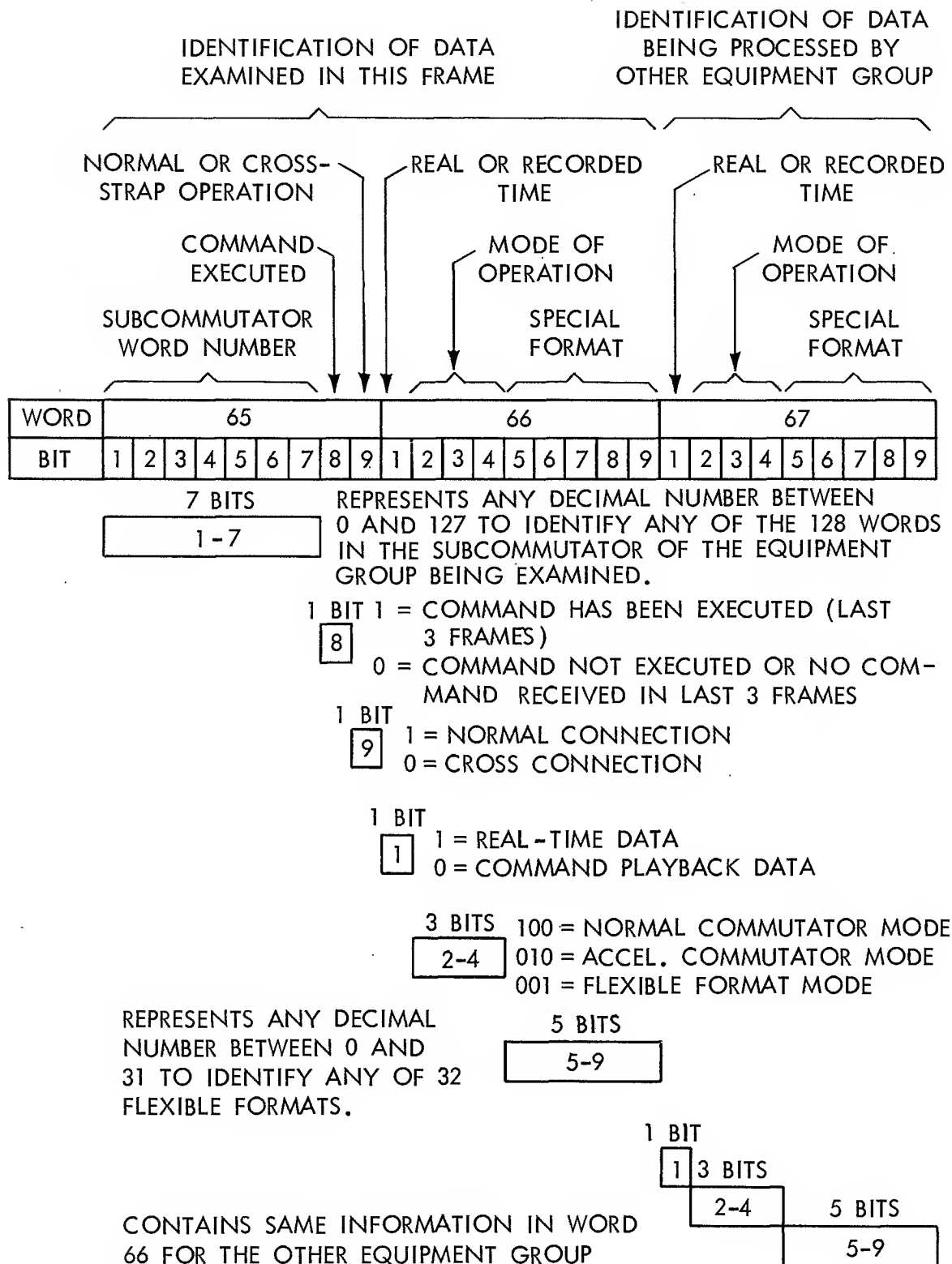


Figure 15-Spacecraft ID words



Spacecraft Clock Words (Words 33-35) – The spacecraft clock register updates once per second and is telemetered in the low-order 25 bits of Words 33, 34, 35 (See Figure 14). Bit 26 is unused, while bit 27 (high-order bit) indicates by a "1" configuration that updating of the clock register has occurred during the last 8 bits of Word 32. This flag is seen consistently only at the 1 k data rate.

Spacecraft Identification Words (Words 65-67) – The spacecraft ID Words reflect the current status of each equipment group: that group which is handling data currently under transmission and that which is not handling the presently transmitted data. The formats of Spacecraft ID Words appear as Figure 15.

Spacecraft Subcommutator Channels (Words 97-99) – OGO has three subcommutators. Subcommutator No. 1 assigns outputs from the spacecraft experiments to Word 97 of the Main Frame. Subcommutators Nos. 2 & 3 assign outputs from spacecraft subsystems sensors to Words 98 & 99 of the Main Frame respectively. The channel assignment formats of subcommutators Nos. 2 and 3 are given as Figures 18 and 19. OGO-B Subcommutator 2 & 3 channel assignments, as they differ from OGO-A and OGO-C, are given as Figure 20. The subcommutators each have 128 outputs and are synchronized with each other and the Main Frame. During assignment of outputs from the Accelerated Subsystems commutator to the 128 word telemetry frame, the outputs of Subcommutator 2 are assigned to corresponding words of the Main Frame, except for Main Frame Words 1-3, 33-35, 65-67, and 97-99, the fixed assignments of which override the corresponding Subcommutator 2 signals.

### Special Purpose Telemetry

OGO-B will employ special purpose telemetry for experiment outputs which are not compatible with wideband PCM telemetry. The special purpose telemetry data will be transmitted as FM/PM modulation on a 400.85 Mc carrier. The bandwidth will be 100 kc.

# OGO-B EXPERIMENT TELEMETRY FORMAT

## SUBCOM I EQUIPMENT GROUP I

1	000	2	001	3	002	4	003	5	004	6	005	7	006	8	007
					16	16	16	16							
					EXTRA COUNTS, TUBE ID	TUBE ID, TUBE DATA	1 <sup>ST</sup> HIT DATA, TUBE ID, 2 <sup>ND</sup> HIT DATA	2 <sup>ND</sup> HIT DATA							
9	010	10	011	11	012	12	013	13	014	14	015	15	016	16	017
15	10				OPEP 2	15	4	6							
1-6 AMU 10 <sup>-9</sup> CURRENT DATA	X AXIS 10 CPS				UNCAGED AND TEMP	7-45 AMU 10 <sup>-9</sup> CURRENT DATA	HIGH VOLTAGE	SCINTILLATOR ASSEMBLY TEMP							
17	020	18	021	19	022	20	023	21	024	22	025	23	026	24	027
15	10				15			18	18	18					
VA SWEEP VOLTAGE	X AXIS 30 CPS				1-6 AMU 10 <sup>-9</sup> CURRENT DATA			CRYSTAL CALIBRATOR	+18 VDC SUPPLY	ANT DEPLOY					
25	030	26	031	27	032	28	033	29	034	30	035	31	036	32	037
15	10				11	15	5	5							
7-45 AMU 10 <sup>-9</sup> CURRENT DATA	X AXIS 100 CPS				HEATER STATUS	ELECTRONICS ASSEMBLY TEMP	12 VDC SUPPLY	ELECTROMETER TEMP							
33	040	34	041	35	042	36	043	37	044	38	045	39	046	40	047
15	10					15									
1-6 AMU 10 <sup>-9</sup> CURRENT DATA	X AXIS 300 CPS					7-45 AMU 10 <sup>-9</sup> CURRENT DATA									
41	050	42	051	43	052	44	053	45	054	46	055	47	056	48	057
15	10				8	15									
7-45 AMU VS STEPPING VOLTAGE	X AXIS 1000 CPS				ELECTRONIC ASSEMBLY TEMP	1-6 AMU 10 <sup>-9</sup> CURRENT DATA									
49	060	50	061	51	062	52	063	53	064	54	065	55	066	56	067
15	10	1				15									
7-45 AMU 10 <sup>-9</sup> CURRENT DATA	X AXIS 10 CPS	PULSE COUNT BY 23 OR 27				1-6 AMU 10 <sup>-9</sup> CURRENT DATA									
57	070	58	071	59	072	60	073	61	074	62	075	63	076	64	077
15	10	2	2	15	F3										
1-6 AMU 10 <sup>-9</sup> CURRENT DATA	Y AXIS 30 CPS	INDEX PULSE SWITCH STATUS	OPEP HV LEVEL	7-45 AMU 10 <sup>-9</sup> CURRENT DATA	RECORDER 1 PLAYBACK FREQ										
65	100	66	101	67	102	68	103	69	104	70	105	71	106	72	107
73	110	74	111	75	112	76	113	77	114	78	115	79	116	80	117
15	10				A29	15	18	14							
1-6 AMU 10 <sup>-9</sup> CURRENT DATA	Y AXIS 100 CPS				OPEP gyro MOTOR BRIDGE CURRENT	7-45 AMU 10 <sup>-9</sup> CURRENT DATA	DEEP I PUL-AMP TEMP	POWER STATUS							
81	120	82	121	83	122	84	123	85	124	86	125	87	126	88	127
15	10	17	19	15	10	10	10	10							
VA SWEEP VOLTAGE	Y AXIS 300 CPS	ANT TEMP	ELECTROMETERS TEMP	1-6 AMU 10 <sup>-9</sup> CURRENT DATA	Y AXIS 10 CPS	Y AXIS 30 CPS	Y AXIS 100 CPS								
89	130	90	131	91	132	92	133	93	134	94	135	95	136	96	137
15	10	10	10	15											
7-45 AMU 10 <sup>-9</sup> CURRENT DATA	Y AXIS 1000 CPS	X AXIS 1000 CPS	Z AXIS 1000 CPS	1-6 AMU VS STEPPING VOLTAGE											
97	140	98	141	99	142	100	143	101	144	102	145	103	146	104	147
15	10	10	10	15	10	10	10								
1-6 AMU 10 <sup>-9</sup> CURRENT DATA	AMPLIFIERS GAIN	X AXIS 10 CPS	Y AXIS 10 CPS	7-45 AMU 10 <sup>-9</sup> CURRENT DATA	X AXIS 100 CPS	X AXIS 300 CPS	X AXIS 1000 CPS								
105	150	106	151	107	152	108	153	109	154	110	155	111	156	112	157
		10	10	10	15	A27	C17	15							
		Z AXIS 30 CPS	X AXIS 30 CPS	Y AXIS 30 CPS	1-6 AMU 10 <sup>-9</sup> CURRENT DATA	OPEP gyro ON-OFF	R & R STATUS	CANDIDATE RING VOLTAGE							
113	160	114	161	115	162	116	163	117	164	118	165	119	166	120	167
15	10	10	10	15				7	7						
7-45 AMU 10 <sup>-9</sup> CURRENT DATA	Z AXIS 100 CPS	X AXIS 100 CPS	Y AXIS 100 CPS	MODULATED 20 VDC SUPPLY				COMPOSITION TELESCOPE TEMP	ALPHA TELESCOPE TEMP						
121	170	122	171	123	172	124	173	125	174	126	175	127	176	128	177
15	10	10	10	15	10	10	10								
1-6 AMU 10 <sup>-9</sup> CURRENT DATA	Z AXIS 300 CPS	AMPLIFIERS GAIN	Z AXIS 30 CPS	7-45 AMU 10 <sup>-9</sup> CURRENT DATA	Z AXIS 100 CPS	Z AXIS 300 CPS	Z AXIS 1000 CPS								

Figure 16-Subcomm 1, EG 1 Format

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
				16	16	16	16									
				EXTRA COUNTS, TUBE ID	TUBE ID, 1ST HIT DATA	1ST HIT DATA, TUBE ID, PREP DATA	2ND HIT DATA									
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
15		15		15		OPEP 2		10		4				15		
ELECTRONICS ASSEMBLY TEMP		VA SWEEP VOLTAGE		7-45 AMU VS STEPPING VOLTAGE		UNCAID AND TEMP		X AXIS 10 CPS		HIGH VOLTAGE				1-6 AMU VS STEPPING VOLTAGE		
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		18		18		18		10								
		CRYSTAL CALIBRATOR		+REVC SUPPLY		AMT DEPLOY		X AXIS 30 CPS								
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
15						11		10		5		5		15		
1-6 AMU & MC RF VOLTAGE						HEATER STATUS		X AXIS 100 CPS		12 VDC SUPPLY		ELECTROMETER TEMP		VA SWEEP VOLTAGE		
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
		15		10		10		10		10		10		10		
		7-45 AMU 5MC RF VOLTAGE		Y AXIS 300 CPS		Z AXIS 300 CPS		X AXIS 300 CPS		X AXIS 30 CPS		Y AXIS 30 CPS		Z AXIS 30 CPS		
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
				15		8		10						15		
				7-45 AMU VS STEPPING VOLTAGE		ELECTRONIC ASSEMBLY TEMP		X AXIS 1000 CPS						1-6 AMU VS STEPPING VOLTAGE		
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
		1				10		15								
		PULSE COUNT BY 27 OR 27				Y AXIS 10 CPS		VA SWEEP VOLTAGE								
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
		2		2		10				6						
		INDEX PULSE SWITCH STATUS		OPEP NVLEVEL		Y AXIS 30 CPS				SCINTILLATOR ASSEMBLY TEMP						
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
		15		15		10		18		14		15				
		VA SWEEP VOLTAGE		7-45 AMU VS STEPPING VOLTAGE		X AXIS 100 CPS		SOEP 1 PREAMP		TEMP		POWER STATUS		1-6 AMU VS STEPPING VOLTAGE		
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
10				17		19		10		15						
Y AXIS 300 CPS				ANT		TEMP		ELECTROMETERS TEMP		Y AXIS 1000 CPS		G. AND GUARD RING VOLTAGE				
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
		10		10		10		10		15		10		10		
		Z AXIS 1000 CPS		Z AXIS 100 CPS		AMPLIFIERS GAIN		Z AXIS 300 CPS		VA SWEEP VOLTAGE		Y AXIS 10 CPS				
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111		

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# OGO-B SPACECRAFT TELEMETRY FORMAT

## SUBCOM 2 EQUIPMENT GROUPS 1 & 2

1	400	2	401	3	402	4	403	5	404	6	405	7	406	8	407
C6 WB TX A REV POWER		C8 WB TX B REV POWER		A1 ARGON HIGH PRESSURE		A2 ARGON LOW PRESSURE		A3 ARGON BOTTLE TEMP		A12 ARRAY SHAFT ANGLE SINE		A13 ARRAY SHAFT ANGLE COSINE			
9	410	10	411	11	412	12	413	13	414	14	415	15	416	16	417
D21 CONV 2 +9 VOLTS		F40 DEPLOY EVENTS EXP ORG BUS		A31 REACTION WHEELS ON-OFF		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6		A14 OPEP ANGLE SINE		A15 OPEP ANGLE COSINE		D47 CHARGE REGUL 1 EVENTS	
17	420	18	421	19	422	20	423	21	424	22	425	23	426	24	427
D1 BATTERY 1 CURRENT		D4 ARRAY 1 CURRENT		D8 BATTERY 1 VOLTAGE		D2 BATTERY 2 CURRENT		D5 ARRAY 2 CURRENT		D9 BATTERY 2 VOLTAGE		A10 YAW ERROR DEGREES		A11 ARRAY ERROR DEGREES	
25	430	26	431	27	432	28	433	29	434	30	435	31	436	32	437
A4 PITCH ERROR DEGREES		A5 ROLL ERROR DEGREES		A6 SCAN HEADS SUN ALARM		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6		D6 ARRAY 1A VOLTAGE		D7 ARRAY 1B VOLTAGE		D48 BATTERY 2 EVENTS	
33	440	34	441	35	442	36	443	37	444	38	445	39	446	40	447
C12 LOW DATA REV POWER		C11 LOW DATA FWD POWER		C9 SP DATA FWD POWER		C5 WB DATA FWD POWER		D28 CONV 5 +16 VOLTS		D29 CONV 5 +9 VOLTS		D30 CONV 5 -8 VOLTS		D31 CONV 5 -18 VOLTS	
41	450	42	451	43	452	44	453	45	454	46	455	47	456	48	457
A7 SCAN HEADS TRACKING CHECK		F40 DEPLOY EVENTS EXP ORG BUS		A31 REACTION WHEELS ON-OFF		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6		D3 BATTERY 1 EVENTS		D10 LOAD BUS VOLTAGE		D49 CHARGE REGUL 2 EVENTS	
49	460	50	461	51	462	52	463	53	464	54	465	55	466	56	467
A16 OPEP AND ARRAY DRIVE MOTORS		A17 ROLL TACH RPM		A18 WHEEL TACH RPM		A19 PITCH TACH RPM		A20 WHEEL TACH RPM		A23 REACTION WHEELS DIRECTION		A24 ACS MODES SUN SENSOR		A40 SCAN HEAD A ANGLE	
57	470	58	471	59	472	60	473	61	474	62	475	63	476	64	477
A44 CSA STATUS		A28 OPEP GYRO MOTOR TACH		A45 ACS POWER RELAY STATUS		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6		D36 CONV 7 +16 VOLTS		D37 CONV 7 +9 VOLTS		D23 CONV 2 -8 VOLTS	
65	500	66	501	67	502	68	503	69	504	70	505	71	506	72	507
						F9 RECORDER 2 +9.5 VOLTS		F10 RECORDER 2 +9.5 VOLTS		A41 SCAN HEAD B ANGLE		A38 EARTH SIZE (A,B,C)		F13 RECORDER 2 GAS PRESSURE	
73	510	74	511	75	512	76	513	77	514	78	515	79	516	80	517
D21 CONV 2 +9 VOLTS		F40 DEPLOY EVENTS EXP ORG BUS		A31 REACTION WHEELS ON-OFF		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6				F42 RECORDER 1 STATUS		D47 CHARGE REGUL 1 EVENTS	
81	520	82	521	83	522	84	523	85	524	86	525	87	526	88	527
F24 E01		F32 E02		F25 E01		F33 E02		F27 E01		F35 E02		F29 E01		F37 E02	
F31 E01		F39 E02		F41 DEPLOY SAFE SIG 1/2 COMMAND SIGNAL PRESENT		D38 CONV 7 -8 VOLTS		C7 WB DATA B FWD POWER							
89	530	90	531	91	532	92	533	93	534	94	535	95	536	96	537
A4 PITCH ERROR DEGREES		A5 ROLL ERROR DEGREES		A6 SCAN HEADS SUN ALARM		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6				F43 RECORDER 2 STATUS			
97	540	98	541	99	542	100	543	101	544	102	545	103	546	104	547
A42 SCAN HEAD C ANGLE		F14 GDHA 1 E01		F15 GDHA 2 E02		F14 GDHA 2 E01		F1 RECORDER 1 +9.5 VOLTS		F2 RECORDER 1 -9.5 VOLTS		A43 SCAN HEAD D ANGLE		A39 EARTH SIZE (A,B,C)	
105	550	106	551	107	552	108	553	109	554	110	555	111	556	112	557
A7 SCAN HEADS TRACKING CHECK		F40 DEPLOY EVENTS EXP ORG BUS		A31 REACTION WHEELS ON-OFF		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6				F44 LFTA BIT RATES		D49 CHARGE REGUL 2 EVENTS	
113	560	114	561	115	562	116	563	117	564	118	565	119	566	120	567
A16 OPEP AND ARRAY DRIVE MOTORS		A17 ROLL TACH RPM		A18 WHEEL TACH RPM		A19 PITCH TACH RPM		A20 WHEEL TACH RPM		A23 REACTION WHEELS DIRECTION		A24 ACS MODES SUN SENSOR		A40 SCAN HEAD A ANGLE	
121	570	122	571	123	572	124	573	125	574	126	575	127	576	128	577
A44 CSA STATUS		A28 OPEP GYRO MOTOR TACH		A45 ACS POWER RELAY STATUS		A21 GAS CONTROL VALVES 1,2,5		A22 GAS CONTROL VALVES 3,4,6				F45 E01		F47 E02	
												F46 E01		F48 E02	

Figure 18-Subcomm 2, EG 1 and 2 Format

# **OGO-B SPACECRAFT TELEMETRY FORMAT** **SUBCOM 3 EQUIPMENT GROUPS 1&2**

1	600	2	601	3	602	4	603	5	604	6	605	7	606	8	607
E1	E2	E3	E4	E5	E6	E7	E8								
ARRAY 1 INBO TEMP	ARRAY 1 OUTBO TEMP	ARRAY 2 INBO TEMP	ARRAY 2 OUTBO TEMP	XX SIDE (ADJ) CONAS TEMP	XX SIDE (ADJ) PUI TEMP	-X SIDE (ADJ) ROLL WHEEL 1 - TEMP	-X SIDE (ADJ) CONV B TEMP								
9	610	10	611	11	612	12	613	13	614	14	615	15	616	16	617
B1	B2	B3	B4	B5	E17	B6	B7								
EP 3 B 360 MC ANT DEPLOY	EP 8 DEPLOY	ARRAY 1 DEPLOY	AGENA REP B DEPLOY	EPL EP2 EP3 DEPLOY	EP 5 TEMP	EP 4 (DE MC ANT B CONTROL) CTB DEPL	OPEP B 400 MC HI DEPLOY								
17	620	18	621	19	622	20	623	21	624	22	625	23	626	24	627
			D13	D14	E13	E14	E15	E16							
			ARRAY 1A THERMAL TUN - TEMP	ARRAY 2A THERMAL TUN - TEMP	EP1 TEMP	EP 2 TEMP	EP 3 TEMP	EP 4 TEMP							
25	630	26	631	27	632	28	633	29	634	30	635	31	636	32	637
D15	D16	D17	D18	D19	E26	D20	D22								
400 SYNC AMP VOLTS	2461 SYNC AMP 2 VOLTS	2461 SYNC AMP 1 VOLTS	CONV 1 +70 VOLTS	CONV 1 +23 VOLTS	SOEP 2 TEMP	CONV 2 +16 VOLTS	CONV 2 +5 VOLTS								
33	640	34	641	35	642	36	643	37	644	38	645	39	646	40	647
A37	E19	E20	E21	E22	E23	E24	E25								
OPEP DRIVE SHAFT TEMP	OPEP 1 TEMP	OPEP 2 TEMP	-2 DOOR (ADJ) EXP 6, 7) TEMP	+2 DOOR (ADJ) EXP 2, 17) TEMP	XX SIDE (ADJ) EXP 23) TEMP	-X SIDE (ADJ) BATTERY PACK B) TEMP	SOEP 2 TEMP								
41	650	42	651	43	652	44	653	45	654	46	655	47	656	48	657
C13	C14	D24	D25	A35	E27	D26	D27								
RX1 AGC1 DBM	RX1 AGC2 DBM	CONV 3 +70 VOLTS	CONV 3 +23 VOLTS	PITCH RATE GYRO RPM	WB XMTR PANEL TEMP	CONV 4 +70 VOLTS	CONV 4 +23 VOLTS								
49	660	50	661	51	662	52	663	53	664	54	665	55	666	56	667
D39	D40	D41	D42	D32	D33	D34	D35								
CONV 8 +16 VOLTS	CONV 8 +9 VOLTS	CONV 8 -8 VOLTS	CONV 9 +80 VOLTS	CONV 8 +16 VOLTS	CONV 8 +9 VOLTS	CONV 8 -8 VOLTS	CONV 8 -16 VOLTS								
57	670	58	671	59	672	60	673	61	674	62	675	63	676	64	677
D43	D44	D45	D46	C4	E28	C15	C16								
CONV 8 +10 VOLTS	CONV 9 -20 VOLTS	CONV 9 28 VDC	ACS INVERTER 400 OPS	10W XMTR TEMP	SOEP 1 TEMP	RX2 AGC1 DBM	RX2 AGC2 DBM								
65	700	66	701	67	702	68	703	69	704	70	705	71	706	72	707
E29	D11	D12	D50	D51	C1	C2	C3								
SOEP 1 TEMP	BATTERY A1 TEMP	BATTERY A2 TEMP	BATTERY B1 TEMP	BATTERY B2 TEMP	WB XMTR A TEMP	WB XMTR B TEMP	SP XMTR TEMP								
73	710	74	711	75	712	76	713	77	714	78	715	79	716	80	717
B1	B2	B3	B4	B5		B6	B7								
EP 3 B 360 MC ANT DEPLOY	EP 8 DEPLOY	ARRAY 1 DEPLOY	AGENA REP B DEPLOY	EPL EP2 EP3 DEPLOY		EP 4 (DE MC ANT B CONVT) CTB DEPLOY	OPEP B 400 MC HI DEPLOY								
81	720	82	721	83	722	84	723	85	724	86	725	87	726	88	727
F26	F34	F28	F36	F30	F38	F8	F16	F17	F20	F22					
EG1	EG2	EG1	EG2	EG1	EG2	RECORDER 1 TEMP	RECORDER 2 TEMP	LEFT A NO ASSY 2 TEMP	DOHA 1 B0 ASSY 4 TEMP	DOHA 2 B0 ASSY 4 TEMP					
89	730	90	731	91	732	92	733	93	734	94	735	95	736	96	737
D15	D16	D17	D18	D19		D20	D22								
400 SYNC AMP VOLTS	2461 SYNC AMP 2 VOLTS	2461 SYNC AMP 1 VOLTS	CONV 1 +70 VOLTS	CONV 1 +23 VOLTS		CONV 2 +16 VOLTS	CONV 2 +5 VOLTS								
97	740	98	741	99	742	100	743	101	744	102	745	103	746	104	747
A34	A33	A32	A30	A26	A25	A9	A8								
PITCH WHEEL TEMP	TAN WHEEL TEMP	ACS INVERTER TEMP	OPEP GYRO CASE TEMP	SUN SENSOR 2 TEMP	SUN SENSOR 1 TEMP	SCAN HDS A B C TEMP	-Y PANEL TEMP								
105	750	106	751	107	752	108	753	109	754	110	755	111	756	112	757
C13	C14	D24	D25	A35		D26	D27								
RX1 AGC1 DBM	RX1 AGC2 DBM	CONV 3 +70 VOLTS	CONV 3 +23 VOLTS	PITCH RATE GYRO RPM		CONV 4 +70 VOLTS	CONV 4 +23 VOLTS								
113	760	114	761	115	762	116	763	117	764	118	765	119	766	120	767
D39	D40	D41	D42	D32	D33	D34	D35								
CONV 8 +16 VOLTS	CONV 8 +9 VOLTS	CONV 8 -8 VOLTS	CONV 9 +20 VOLTS	CONV 8 +16 VOLTS	CONV 8 +9 VOLTS	CONV 8 -8 VOLTS	CONV 8 -16 VOLTS								
121	770	122	771	123	772	124	773	125	774	126	775	127	776	128	777
D43	D44	D45	D46	C4		C15	C16								
CONV 8 +10 VOLTS	CONV 9 -20 VOLTS	CONV 9 28 VDC	ACS INVERTER 400 OPS	10W XMTR TEMP		RX2 AGC1 DBM	RX2 AGC2 DBM								

Figure 19-Subcomm 3, EG 1 and 2 Format

# Subcommutator #2 (Channel 98)

## OGO-A

1	C6	Power -WB/TX#1 Rev.
2	C8	Power -WB/TX#2 Rev.
3	C10	Power SP/TX
4	A1	Argon High Pressure
5	A2	Argon Low Pressure
6	A3	Temp. Argon Bottle
7	A12	Array Shaft sine
8	A13	Array Shaft cosine
9	D21	Voltage Conv. #2 (+9v)
10	F40	Boom deployment
11	A31	Reaction Wheel drive
12	A21	Gas Valves
13	A22	Gas Valves
14	A14	OPEP sine
15	A15	OPEP cosine
16	D47	Charge Reg. #1
17	D1	Batt. #1 Charge Current
18	D4	Paddle #1 current
19	D8	Batt. #1 voltage out
20	D2	Batt. #2 charge current
21	D5	Paddle #2 current
22	D9	Batt. #2 voltage out
23	A10	Yaw error signal
24	A11	Array error signal
25	A4	Pitch error
26	A5	Roll error
27	A6	Sun Alarm Signal
28	A21	Gas valves
29	A22	Gas valves
30	D6	Paddle 1a volts
31	D7	Paddle 1b volts
32	D48	Charge Reg. #2
33	C12	Power-Tracking/TX (Rev)
34	C11	Power-Tracking/TX (Fwd)
35	C9	Power-SP/TX (Fwd)
36	C5	Power-WB/TX 1 (Fwd)
37	D28	Voltage Conv #5 (+16V)
38	D29	Voltage Conv #5 (+9v)
39	D30	Voltage Conv #5 (-6v)
40	D31	Voltage Conv #5 (-16v)
41	A7	Horizon Scanner heads
42	F40	Boom deployment
43	A31	Reaction wheel drive

## OGO-A

44	A21	Gas valves
45	A22	Gas valves
46	D3	Charge Reg. #1
47	D10	Load Bus
48	D49	Charge Reg. #2
49	A16	Drive motors
50	A17	Roll tach
51	A18	Pitch Tach
52	A19	Yaw Tach
53	A20	Reaction Wheel Direction
54	A23	ACS mode
55	A24	Pitch rate gyro
56		
57	A27	Gyro A or B
58	A28	Gyro motor volts
59	A29	Gyro motor current
60	A21	Gas valves
61	A22	Gas valves
62	D36	Voltage conv 7 (+16v)
63	D37	Voltage conv 7 (+9v)
64	D23	Voltage conv 2 (-6v)
65		
66		
67		
68	F9	Tape Record #2 (+9.5v)
69	F10	Tape Record #2 (-9.5v)
70	F11	Tape record #2 $\phi$ detector
71		
72	F13	Tape Record #2 pressure
73	D21	Voltage Conv #2 (+9v)
74	F40	Boom deployment
75	A31	Reaction wheel drive
76	A21	Gas valves
77	A22	Gas valves
78		
79	F42	Tape Record #1 status
80	D47	DDHA #2 status
81	F24	Temp. ADHA
82	F25	Voltage Cal. (0)
83	F27	Voltage Cal. (1.7)
84	F29	Voltage Cal. (3.18)
85	F31	Voltage Cal. (5.06)
86	F41	Rec. Signal Present

## OGO-A

87	D38	Voltage conv 7 (-6v)
88	C7	Power WB/TX 2 (Fwd)
89	A4	Pitch error
90	A5	Roll error
91	A6	Sun Alarm Signal
92	A21	Gas valves
93	A22	Gas valves
94		
95	F43	Tape Record #2 status
96		
97	A36	ACS inverter output
98	F14	Temp. DDHA #1 OSC.
99	F15	Temp. DDHA #2 OSC.
100	F1	Tape Record #1 (+9.5v)
101	F2	Tape Record #1 (-9.5v)
102	F3	Tape Record #1 $\phi$ detector
103		
104	F5	Tape Record #1 pressure
105	A7	Horizon scanner heads
106	F40	Boom deploy
107	A31	Reaction wheel drive
108	A21	Gas valves
109	A22	Gas valves
110		
111	F44	LFTA status
112	D49	Charge reg. #2
113	A16	Drive motors, Array, OPEP
114	A17	Roll tach
115	A18	Pitch tach
116	A19	Yaw Tach
117	A20	Reaction wheel direction
118	A23	ACS mode
119	A24	Pitch rate gyro
120		
121	A27	Gyro A or B
122	A28	Gyro motor (volts)
123	A29	Gyro motor (amps)
124	A21	Gas valves
125	A22	Gas valves
126		
127	F45	DDHA #1 status
128	F46	DDHA #1 status

Figure 20-OGO A, B, C Subcomm 2 and 3 Channel Assignments Compared

Subcommutator #3 (Channel 99)

OGO-A		OGO-A		OGO-A	
1	E1	Temp. Paddle #1 (-X) IN	44	D25	Voltage conv. 3 (+23v)
2	E2	Temp. Paddle #1 (-X) OUT	45	A35	Pitch rate gyro tach
3	E3	Temp. Paddle #2 (+X) IN	46	E27	Temp. radiator
4	E4	Temp. Paddle #2 (+X) OUT	47	D26	Voltage conv. 4 (+70v)
5	E5	Temp. Mounting Plate (+X)	48	D27	Voltage conv. 4 (+23v)
6	E6	Temp. Mounting Plate (+X)	49	D39	Voltage conv. 8 (+16v)
7	E7	Temp. Mounting Plate (-X)	50	D40	Voltage conv. 8 (+9v)
8	E8	Temp. Mounting Plate (-X)	51	D41	Voltage conv. 8 (-6v)
9	B1	EP5 hinge 1,2,3; 360 ant. hinge	52	D42	Voltage conv. 9 (+20v)
10	B2	EP6 hinge 1,2,3	53	D32	Voltage conv. 6 (+16v)
11	B3	Paddle #1 hinge 1,2,3	54	D33	Voltage conv. 6 (+9v)
12	B4	Paddle #2 hinge 1,2,3	55	D34	Voltage conv. 6 (-6v)
13	B5	EP1, EP2, EP3, 400 mc ant hinge 1	56	D35	Voltage conv. 6 (-16v)
14	E17	Temp. EP5	57	D43	Voltage conv. 9 (+10v)
15	B6	136 ant, EP4, Cont. jet 1,2, hinge	58	D44	Voltage conv. 9 (-20v)
16	B7	400 ant, OPEP drive hinge 1,2	59	D45	Voltage conv. 9 2461 AC
17			60	D46	ACS inverter 400 cps
18			61	C4	Temp. Tracking TX
19	D13	Temp. Chg. Reg. Paddle #1	62	E28	Temp. SOEP -X (+Y)
20	D14	Temp. Chg. Reg. Paddle #2	63	C15	RX#2 AGC1
21	E13	Temp. EP1	64	C16	RX#2 AGC2
22	E14	Temp. EP2	65	E29	Temp. SOEP -X (-Y)
23	E15	Temp. EP3	66	D11	Temp. Batt. 1a
24	E16	Temp. EP4	67	D12	Temp. Batt. 1b
25	D15	Sync signal amplitude 400 cps	68	D50	Temp. Batt. 2a
26	D16	Sync signal amplitude 2461 cps 0°	69	D51	Temp. Batt. 2b
27	D17	Sync signal amplitude 2461 cps 90°	70	C1	Temp. WB/TX #1
28	D18	Voltage Conv. 1 (+70v)	71	C2	Temp. WB/TX #2
29	D19	Voltage Conv. 1 (+23v)	72	C3	Temp. SP/TX
30	E26	Temperature SOEP +X (-Y)	73	B1	EP5 hinge 1,2,3; 360 ant hinge
31	D20	Voltage conv. 2 (+16v)	74	B2	EP6 hinge 1,2,3
32	D22	Voltage conv. 2 (+5v)	75	B3	Paddle 1 hinge 1,2,3
33	A37	Temp. OPEP drive shaft	76	B4	Paddle 2 hinge 1,2,3
34	E19	Temp. OPEP 1 + Z	77	B5	EP1, EP2, EP3, 400 ant, hinge 1
35	E20	Temp. OPEP 2 - Z	78		
36	E21	Temp. exp. mtg. plate (-Z)	79	B6	136 ant, EP4, Cont. jet 1,2 hinge
37	E22	Temp. exp. mtg. plate (+Z)	80	B7	400 ant, OPEP drive hinge 1,2
38	E23	Temp. exp. mtg. plate (+X)	81	F26	Voltage Cal. (0.5)
39	E24	Temp. exp. mtg. plate (-X)	82	F28	Voltage Cal. (2.64)
40	E25	Temp. SOEP +X (+Y)	83	F30	Voltage Cal. (4.12)
41	C13	Rx#1 AGC-1	84	F8	Temp. Tape Record 1
42	C14	Rx#1 AGC-2	85	F16	Temp. Tape Record 2
43	D24	Voltage conv. 3 (+70v)	86	F17	Temp. LFTA

Figure 20-OGO A, B, C Subcomm 2 and 3 Channel Assignments Compared (Continued)



## Subcommutator #2 (Channel 98)

## OGO-B

1 C6 Power -WB/TX #1 Rev.  
 2 C8 Power -WB/TX #2 Rev.  
 3  
 4 A1 Argon High Pressure  
 5 A2 Argon Low Pressure  
 6 A3 Temp. Argon Bottle  
 7 A12 Array Shaft sine  
 8 A13 Array Shaft cosine  
 9 D21 Voltage Conv. #2 (+9v)  
 10 F40 Boom deployment  
 11 A31 Reaction wheel drive  
 12 A21 Gas valves  
 13 A22 Gas valves  
 14 A14 OPEP sine  
 15 A15 OPEP cosine  
 16 D47 Charge Reg. #1  
 17 D1 Batt. #1 Charge Current  
 18 D4 Paddle #1 current  
 19 D8 Batt. #1 voltage out  
 20 D2 Batt. #2 charge current  
 21 D5 Paddle #2 current  
 22 D9 Batt. #2 voltage out  
 23 A10 Yaw error signal  
 24 A11 Array error signal  
 25 A4 Pitch error  
 26 A5 Roll error  
 27 A6 Sun Alarm Signal  
 28 A21 Gas valves  
 29 A22 Gas valves  
 30 D6 Paddle 1a volts  
 31 D7 Paddle 1b volts  
 32 D48 Charge Reg. #2  
 33 C12 Power-Tracking/TX (Rev)  
 34 C11 Power-Tracking/TX (Fwd)  
 35 C9 Power-SP/TX (Fwd)  
 36 C5 Power-WB/TX 1 (Fwd)  
 37 D28 Voltage Conv #5 (+16v)  
 38 D29 Voltage Conv #5 (+9v)  
 39 D30 Voltage Conv #5 (-6v)  
 40 D31 Voltage Conv #5 (-16v)  
 41 A7 Horizon Scanner heads  
 42 F40 Boom deployment  
 43 A31 Reaction wheel drive

## OGO-B

44 A21 Gas valves  
 45 A22 Gas valves  
 46 D3 Charge Reg. #1  
 47 D10 Load Bus  
 48 D49 Charge Reg. #2  
 49 A16 Drive motors  
 50 A17 Roll tach  
 51 A18 Pitch Tach  
 52 A19 Yaw Tach  
 53 A20 Reaction wheel direction  
 54 A23 ACS mode  
 55 A24 Pitch rate gyro  
 56  
 57 A27 Gyro A or B  
 58 A28 Gyro motor volts  
 59 A20 Gyro motor current  
 60 A21 Gas valves  
 61 A22 Gas valves  
 62 D36 Voltage conv. 7 (+16v)  
 63 D37 Voltage conv. 7 (+9v)  
 64 D23 Voltage conv. 2 (-6v)  
 65  
 66  
 67  
 68 F9 Tape Record #2 (+9.5v)  
 69 F10 Tape Record #2 (-9.5v)  
 70 F11 Tape Record #2  $\phi$  detector  
 71 A38 Earth Size (A,C)  
 72 F13 Tape Record #2 pressure  
 73 D21 Voltage conv. #2 (+9v)  
 74 F40 Boom deployment  
 75 A31 Reaction wheel drive  
 76 A21 Gas valves  
 77 A22 Gas valves  
 78  
 79 F42 Tape Record #1 status  
 80 D47 DDHA #2 status  
 81 F24 Temp. ADHA  
 82 F25 Voltage Cal. (0)  
 83 F27 Voltage Cal. (1.7)  
 84 F29 Voltage Cal. (3.18)  
 85 F31 Voltage Cal. (5.06)  
 86 F41 Rec. Signal Present

## OGO-B

87 D38 Voltage conv. 7 (-6v)  
 88 C7 Power WB/TX 2 (Fwd)  
 89 A4 Pitch error  
 90 A5 Roll error  
 91 A6 Sun Alarm Signal  
 92 A21 Gas valves  
 93 A22 Gas valves  
 94  
 95 F43 Tape Record #2 status  
 96  
 97  
 98 F14 Temp. DDHA #1 OSC.  
 99 F15 Temp. DDHA #2 OSC  
 100 F1 Tape Record #1 (+9.5v)  
 101 F2 Tape Record #1 (-9.5v)  
 102 F3 Tape Record #1  $\phi$  detector  
 103 A39 Earth Size (B,D)  
 104 F5 Tape Record #1 pressure  
 105 A7 Horizon scanner heads  
 106 F40 Boom deploy  
 107 A31 Reaction wheel drive  
 108 A21 Gas valves  
 109 A22 Gas valves  
 110  
 111 F44 LFTA status  
 112 D49 Charge reg. #2  
 113 A16 Drive motors, Array, OPEP  
 114 A17 Roll tach  
 115 A18 Pitch tach  
 116 A19 Yaw tach  
 117 A20 Reaction wheel direction  
 118 A23 ACS mode  
 119 A24 Pitch rate gyro  
 120  
 121 A27 Gyro A or B  
 122 A28 Gyro motor (volts)  
 123 A29 Gyro motor (amps)  
 124 A21 Gas valves  
 125 A22 Gas valves  
 126  
 127 F45 DDHA #1 status  
 128 F46 DDHA #1 status

Figure 20-OGO A, B, C Subcomm 2 and 3 Channel Assignments Compared (Continued)

# Subcommutator #3 (Channel 99)

## OGO-B

1 E1 Temp. Paddle #1 (-X) IN  
 2 E2 Temp. Paddle #1 (-X) OUT  
 3 E3 Temp. Paddle #2 (+X) IN  
 4 E4 Temp. Paddle #2 (+X) OUT  
 5 E5 Temp. Mounting Plate (+X)  
 6 E6 Temp. Mounting Plate (+X)  
 7 E7 Temp. Mounting Plate (-X)  
 8 E8 Temp. Mounting Plate (-X)  
 9 B1 EP5 hinge 1,2,3; 360 ant. hinge  
 10 B2 EP6 hinge 1,2,3  
 11 B3 Paddle #1 hinge 1,2,3  
 12 B4 Paddle #2 hinge 1,2,3  
 13 B5 EP1, EP2, EP3, 400 mc ant hinge 1  
 14 E17 Temp. EP 5  
 15 B6 136 ant, EP4, Cont. jet 1,2 hinge  
 16 B7 400 ant, OPEP drive hinge 1,2  
 17

18  
 19 D13 Temp. Chg. Reg. Paddle #1  
 20 D14 Temp. Chg. Reg. Paddle #2  
 21 E13 Temp. EP1  
 22 E14 Temp. EP2  
 23 E15 Temp. EP3  
 24 E16 Temp. EP4

25 D15 Sync signal amplitude 400 cps  
 26 D16 Sync signal amplitude 2461 cps 0°  
 27 D17 Sync signal amplitude 2461 cps 90°  
 28 D18 Voltage Conv 1 (+70v)  
 29 D19 Voltage Conv. 1 (+23v)  
 30 E26 Temperature SOEP +X (-Y)  
 31 D20 Voltage conv. 2 (+16v)  
 32 D22 Voltage conv. 2 (+5v)  
 33 A37 Temp. OPEP drive shaft  
 34 E19 Temp. OPEP 1 +Z  
 35 E20 Temp. OPEP 2 -Z  
 36 E21 Temp. exp. mtg. plate (-Z)  
 37 E22 Temp. exp. mtg. plate (+Z)  
 38 E23 Temp. exp. mtg. plate (+X)  
 39 E24 Temp. exp. mtg. plate (-X)  
 40 E25 Temp. SOEP +X (+Y)  
 41 C13 Rx#1 AGC-1  
 42 C14 Rx#1 AGC-2  
 43 D24 Voltage conv. 3 (+70v)

## OGO-B

44 D25 Voltage conv. 3 (+23v)  
 45 A35 Pitch rate gyro tach  
 46 E27 Temp. radiator  
 47 D26 Voltage conv. 4 (+70v)  
 48 D27 Voltage conv. 4 (+23v)  
 49 D39 Voltage conv. 8 (+16v)  
 50 D40 Voltage conv. 8 (+9v)  
 51 D41 Voltage conv. 8 (-6v)  
 52 D42 Voltage conv. 9 (+20v)  
 53 D32 Voltage conv. 6 (+16v)  
 54 D34 Voltage conv. 6 (+9v)  
 55 D34 Voltage conv. 6 (-6v)  
 56 D35 Voltage conv. 6 (-16v)  
 57 D43 Voltage conv. 9 (+10v)  
 58 D44 Voltage conv. 9 (-20v)  
 59 D45 Voltage conv. 9 2461 AC  
 60 D46 ACS inverter 400 cps  
 61 C4 Temp. Tracking TX  
 62 E28 Temp. SOEP -X (+Y)  
 63 C15 RX #2 AGC 1  
 64 C16 RX #2 AGC 2  
 65 E29 Temp. SOEP -X (-Y)  
 66 D11 Temp. Batt. 1a  
 67 D12 Temp. Batt. 1b  
 68 D50 Temp. Batt. 2a  
 69 D51 Temp. Batt. 2b  
 70 C1 Temp. WB/TX #1  
 71 C2 Temp. WB/TX #2  
 72 C3 Temp. SP/TX  
 73 B1 EP5 hinge 1,2,3; 360 ant hinge  
 74 B2 EP6 hinge 1,2,3  
 75 B3 Paddle 1 hinge 1,2,3  
 76 B4 Paddle 2 hinge 1,2,3  
 77 B5 EP1, EP2, EP3, 400 ant, hinge 1  
 78  
 79 B6 136 ant, EP4, Cont. jet 1,2 hinge  
 80 B7 400 ant, OPEP drive hinge 1,2  
 81 F26 Voltage Cal. (0.5)  
 82 F28 Voltage Cal. (2.64)  
 83 F30 Voltage Cal. (4.12)  
 84 F8 Temp. Tape Record 1  
 85 F16 Temp. Tape Record 2  
 86 F17 Temp LFTA

## OGO-B

87 F20 Temp. DDHA 1  
 88 F22 Temp. DDHA 2  
 89 D15 Sync signal amplitude 400 cps  
 90 D16 Sync signal amplitude 2461 0°  
 91 D17 Sync signal amplitude 2461 90°  
 92 D18 Voltage conv. 1 (+70v)  
 93 D19 Voltage conv. 1 (+23v)  
 94  
 95 D20 Voltage conv. 2 (+16v)  
 96 D22 Voltage conv. 2 (+5v)  
 97 A34 Temp. pitch reaction wheel  
 98 A33 Temp. yaw reaction wheel  
 99 A32 Temp. ACS inverter  
 100 A30 Temp. OPEP gyro bracket  
 101 A26 Temp. Sun sensor #2  
 102 A25 Temp. Sun sensor #1  
 103 A9 Temp. Horizon scanner head 2  
 104 A8 Temp. Panel (-Y, middle)  
 105 C13 RX #1 AGC-1  
 106 C14 RX #1 AGC-2  
 107 D24 Voltage conv. 3 (+70v)  
 108 D25 Voltage conv. 3 (+23v)  
 109 A35 Pitch rate gyro tack  
 110  
 111 D26 Voltage conv. 4 (+70v)  
 112 D27 Voltage conv. 4 (+23v)  
 113 D39 Voltage conv. 8 (+16v)  
 114 D40 Voltage conv. 8 (+9v)  
 115 D41 Voltage conv. 8 (-6v)  
 116 D42 Voltage conv. 9 (+20v)  
 117 D32 Voltage conv. 6 (+16v)  
 118 D33 Voltage conv. 6 (+9v)  
 119 D34 Voltage conv. 6 (-6v)  
 120 D35 Voltage conv. 6 (-16v)  
 121 D43 Voltage conv. 9 (+10v)  
 122 D44 Voltage conv. 9 (-20v)  
 123 D45 Voltage conv. 9 2461 AC  
 124 D46 ACS inverter 400 cps  
 125 C4 Temp. tracking TX  
 126  
 127 C15 RX #2 AGC-1  
 128 C16 RX #2 AGC-2

Figure 20-OGO A, B, C Subcomm 2 and 3 Channel Assignments Compared (Continued)

Subcommutator #2 (Channel 98)

OGO-C

1 C6 Power -WB/TX #1 Rev.  
 2 C8 Power -WB/TX #2 Rev.  
 3 F24 Temp. ADHA  
 4 A1 Argon High Pressure  
 5 B1 E.P. #5 and 360 ant hinges  
 6 A3 Temp. Argon Bottle  
 7 A12 Array Shaft sine  
 8 A13 Array shaft cosine  
 9 D1 Batt. #1 current  
 10 F40 Boom deployment  
 11 A31 Reaction Wheel drive  
 12 A21 Gas valves  
 13 A22 Gas valves  
 14 D49 Charge Rate Status  
 15 B10 Pre-deployment EP 1,2,3  
 16 D2 Batt. #2 current  
 17 D11 Bus Status  
 18 D4 Paddle #1 current  
 19 D8 Batt. #1 voltage out  
 20 D47 Batt. #1 status  
 21 D5 Paddle #2 current  
 22 D9 Batt. #2 voltage out  
 23 A39 Earth Size  
 24 A11 Array error signal  
 25 A4 Pitch error  
 26 A5 Roll error  
 27 A6 Sun Alarm Signal  
 28 A21 Gas valves  
 29 A22 Gas valves  
 30 D6 Paddle 1a volts  
 31 D7 Paddle 1b volts  
 32 D48 Batt. #2 status  
 33 B12 Deploy bottles press. #2 (+Z, top)  
 34 B13 Deploy bottles press. #3 (-Z top)  
 35 F9 Tape Record #2 (volts)  
 36 C5 Power -WB/TX 1 (Fwd)  
 37 D42 ACS conv. 9 (+20v)  
 38 D44 ACS conv. 9 (-20v)  
 39 D45 ACS conv. 9 (28v)  
 40 D46 ACS inverter 400 cps. volts  
 41 A7 Horizon Scanner heads  
 42 A10 Yaw error  
 43 A31 Reaction wheel drive

OGO-C

44 A21 Gas valves  
 45 A22 Gas valves  
 46 D55 Batt. #1 3 cell volts  
 47 D43 ACS conv. #9 (+10v)  
 48 D10 Load bus  
 49 A16 Drive motors  
 50 A17 Roll tach  
 51 A18 Pitch tach  
 52 A19 Yaw tach  
 53 A20 Reaction wheel direction  
 54 A23 ACS mode  
 55 A24 Pitch rate gyro  
 56 B3 Paddle #1 hinge  
 57 B2 EP #6 hinge  
 58 B6 136 ant, EP4, cont. jet 1 & 2, hinge  
 59 B7 hi gain ant, OPEP drive hinge  
 60 A21 Gas valves  
 61 A22 Gas valves  
 62 D17 Array 1 (-X) current  
 63 D20 Voltage conv. 2 (+16v)  
 64 D23 Voltage conv. 2 (-6v)  
 65 F3 Tape Record 1  $\phi$  detector  
 66 F10 Tape Record 2 -9.5v  
 67 F11 Tape Record 2  $\phi$  detector  
 68 C9 Power SP/TX (Fwd)  
 69 D58 #2 Thermal fin drive (volts)  
 70 D22 Voltage conv. 2 (+5v)  
 71 B8 Pre-deploy array 1, OPEP 1, EP5,6  
 72 F13 Tape Record #2 pressure  
 73 D1 Batt. #1 current  
 74 F40 Boom deployment  
 75 A31 Reaction wheel drive  
 76 A21 Gas valves  
 77 A22 Gas valves  
 78  
 79 F42 Tape Record #1 status  
 80 D2 Batt. #2 current  
 81 A38 Earth Size  
 82 F25 Voltage Cal. (0)  
 83 F27 Voltage Cal. (1.7)  
 84 F29 Voltage Cal. (3.18)  
 85 F31 Voltage Cal. (5.06)  
 86 B4 Agena Sep., Array 2 hinge

OGO-C

87 D56 Batt. #2 3 cell volts  
 88 C7 Power WB/TX 2 (Fwd)  
 89 A4 Pitch error  
 90 A5 Roll error  
 91 A6 Sun Alarm Signal  
 92 A21 Gas valves  
 93 A22 Gas valves  
 94  
 95 F43 Tape Record #2 status  
 96  
 97 F14 Temp. DDHA #1 OSC.  
 98 D3 Reg. Failure Mode Status  
 99 F15 Temp. DDHA #2 OSC.  
 100 D50 Temp. Batt. #2  
 101 D51 Temp. Batt. #1  
 102 D57 #1 Thermal fin drive (volts)  
 103 B9 Pre-deploy 2 EP4, Array 2, OPEP 2  
 104 F5 Tape Record #1 pressure  
 105 A7 Horizon scanner heads  
 106 A10 Yaw error  
 107 A31 Reaction wheel drive  
 108 A21 Gas valves  
 109 A22 Gas valves  
 110  
 111 F44 LFTA status  
 112 D10 Load Bus  
 113 A16 Drive motors, Array, OPEP  
 114 A17 Roll tach  
 115 A18 Pitch tach  
 116 A19 Yaw tach  
 117 A20 Reaction wheel direction  
 118 A23 ACS mode  
 119 A24 Pitch rate gyro  
 120 B3 Array 1 hinge 1,2,3  
 121 B2 EP 6, hinge 1,2,3  
 122 B6 136 ant, EP4, Cont jet 1,2, hinge  
 123 B7 Hi gain ant, OPEP drive hinge  
 124 A21 Gas valves  
 125 A22 Gas valves  
 126  
 127 F45 DDHA #1 status  
 128 F46 DDHA #1 status

Figure 20-OGO A, B, C Subcomm 2 and 3 Channel Assignments Compared (Continued)

# Subcommutator #3 (Channel 99)

## OGO-C

1 E1 Temp. Paddle #1 (-X) IN  
2 E2 Temp. Paddle #1 (-X) OUT  
3 E3 Temp. Paddle #2 (+X) IN  
4 E4 Temp. Paddle #2 (+X) OUT  
5 E5 Temp. Mounting Plate (+X)  
6 E6 Temp. Mounting Plate (+X)  
7 E7 Temp. Mounting Plate (-X)  
8 E8 Temp. Mounting Plate (-X)  
9 A2 Argon Low pressure  
10 A27 OPEP gyro A/B  
11 A29 OPEP gyro motor error rate  
12 F41 Rx 1&2 signal present  
13 A32 Temp. ACS inverter  
14 A17 Temp. EP 5  
15 A14 OPEP sine  
16 A15 OPEP cosine  
17 D52 Voltage conv. 10 (+16v)  
18 D54 Voltage conv. 10 (-6v)  
19 D13 Temp. Chg. Reg. Paddle #1  
20 D14 Temp. Chg. Reg. Paddle #2  
21 E13 Temp. EP1  
22 E14 Temp. EP2  
23 E15 Temp. EP3  
24 E16 Temp. EP4  
25 D15 Sync signal amplitude 400 cps  
26 D16 Sync signal amplitude 2461 cps 0°  
27 D36 Voltage conv. 7 (+16v)  
28 D37 Voltage conv. 7 (+9v)  
29 D38 Voltage conv. 7 (-6v)  
30 E26 Temp. SOEP #1 (-X)  
31 A36 ACS inverter output  
32 D53 Voltage conv. 10 (+9v)  
33 A37 Temp. OPEP drive shaft  
34 E19 Temp. OPEP 1 +Z  
35 E20 Temp. OPEP 2 -Z  
36 E21 Temp. exp. mtg. plate (-Z)  
37 E22 Temp. exp. mtg. plate (+Z)  
38 E23 Temp. exp. mtg. plate (+X)  
39 E24 Temp. exp. mtg. plate (-X)  
40 B14 Deploy bottles press. 4 (-Z bottom)  
41 C13 Rx #1 AGC-1  
42 C14 Rx #1 AGC-2  
43 D24 Voltage conv. 3 (+70v)

## OGO-C

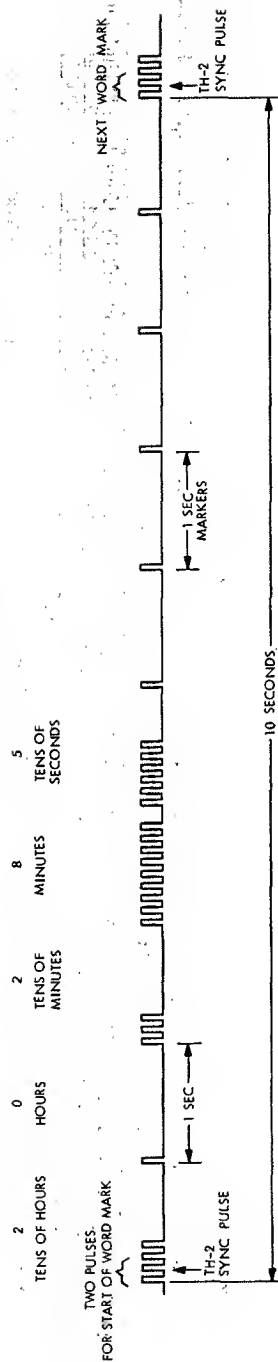
44 D25 Voltage conv. 3 (+23v)  
45 A35 Pitch rate gyro tack  
46 B15 Temp. cable  
47 D26 Voltage conv. 4 (+70v)  
48 D27 Voltage conv. 4 (+23v)  
49 D39 Voltage conv. 8 (+16v)  
50 D40 Voltage conv. 8 (+9v)  
51 D41 Voltage conv. 8 (-6v)  
52 A28 OPEP gyro motor tack  
53 D32 Voltage conv. 6 (+16v)  
54 D33 Voltage conv. 6 (+9v)  
55 D34 Voltage conv. 6 (-6)  
56 D35 Voltage conv. 6 (-16v)  
57 D28 Voltage conv. 5 (+16v)  
58 D29 Voltage conv. 5 (+9v)  
59 D30 Voltage conv. 5 (-6v)  
60 D31 Voltage conv. 5 (-16v)  
61 B11 Deploy bottles press. 1 (+Z bottom)  
62 E28 Temp. EP1  
63 C15 Rx #2 AGC 1  
64 C16 Rx #2 AGC 2  
65 E29 Temp. SOEP #2 (+X)  
66 D21 Voltage conv. 2 (+9v)  
67 D12 Batt. Limits + status  
68 F1 Voltage Tape Record 1 (+9.5)  
69 F2 Voltage Tape Record 1 (-9.5)  
70 C1 Temp. WB/TX #1  
71 C2 Temp. WB/TX #2  
72 C3 Temp. SP/TX  
73 A2 Argon Low Pressure  
74 A27 OPEP gyro A/B  
75 A29 Gyro motor error rate  
76 F41 Rx 1+2 signal present  
77 A32 Temp. ACS inverter  
78  
79 A14 OPEP sine  
80 A15 OPEP cosine  
81 F26 Voltage Cal. (0.5)  
82 F28 Voltage Cal. (2.64)  
83 F30 Voltage Cal. (4.12)  
84 F8 Temp. Tape Record 1  
85 F16 Temp. Tape Record 2  
86 F17 Temp. LFTA

## OGO-C

87 F20 Temp. DDHA 1  
88 F22 Temp. DDHA 2  
89 D15 Sync signal amplitude 400 cps  
90 D16 Sync signal amplitude 2461 0°  
91 D17 Voltage conv. 7 (+16v)  
92 D37 Voltage conv. 7 (+9)  
93 D38 Voltage conv. 7 (-6v)  
94  
95 A36 ACS inverter output  
96 D53 Voltage conv. 10 (+9v)  
97 A34 Temp. pitch reaction wheel  
98 A33 Temp. yaw reaction wheel  
99 B5 EP1, EP2, EP3, 400 ant hinge 1  
100 A30 Temp. OPEP gyro bracket  
101 A26 Temp. Sun sensor #2  
102 A25 Temp. Sun sensor #1  
103 A9 Temp. horizon scanner head A  
104 E30 Temp. Panel (-Y, middle)  
105 C13 RX #1 AGC-1  
106 C14 RX #1 AGC-2  
107 D24 Voltage conv. 3 (+70v)  
108 D25 Voltage conv. 3 (+23v)  
109 A35 Pitch rate gyro tack  
110  
111 D26 Voltage conv. 4 (+70v)  
112 D27 Voltage conv. 4 (+23v)  
113 D39 Voltage conv. 8 (+16v)  
114 D40 Voltage conv. 8 (+9v)  
115 D41 Voltage conv. 8 (-6v)  
116 A28 OPEP gyro motor tack  
117 D32 Voltage conv. 6 (+16v)  
118 D33 Voltage conv. 6 (+9v)  
119 D34 Voltage conv. 6 (-6v)  
120 D35 Voltage conv. 6 (-16v)  
121 D28 Voltage conv. 5 (+16v)  
122 D29 Voltage conv. 5 (+9v)  
123 D30 Voltage conv. 5 (-6v)  
124 D31 Voltage conv. 5 (-16v)  
125 B11 Deploy bottles press. 1 (+Z bottom)  
126  
127 C15 RX #2 AGC-1  
128 C16 RX #2 AGC-2

Figure 20-OGO A, B, C Subcomm 2 and 3 Channel Assignments Compared (Continued)

# NASA SERIAL DECIMAL TIME CODE



# NASA BCD TIME CODE

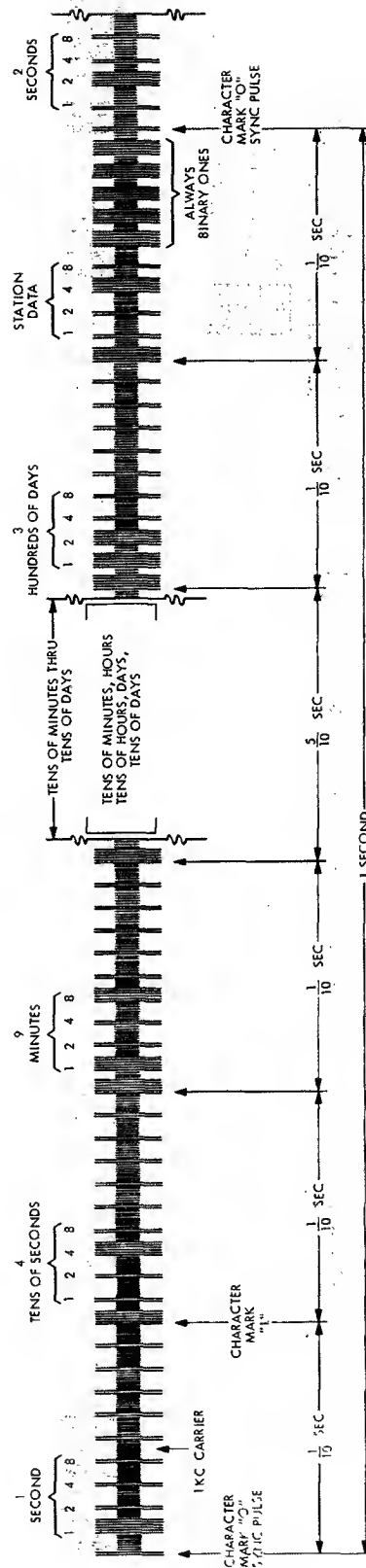


Figure 21-BCD, SD, WWV Time Code

Details of the time-code transmissions from radio station WWV. For this particular example, the signals indicate the 50th second of the 23rd minute, of the 10th hour, of the 121st day of the current year. One second later, the first of the "units" pulses in the group designating "seconds" will change from "0" (a 2-millisecond pulse) to "1" (a 6-millisecond pulse), indicating the 51st second.

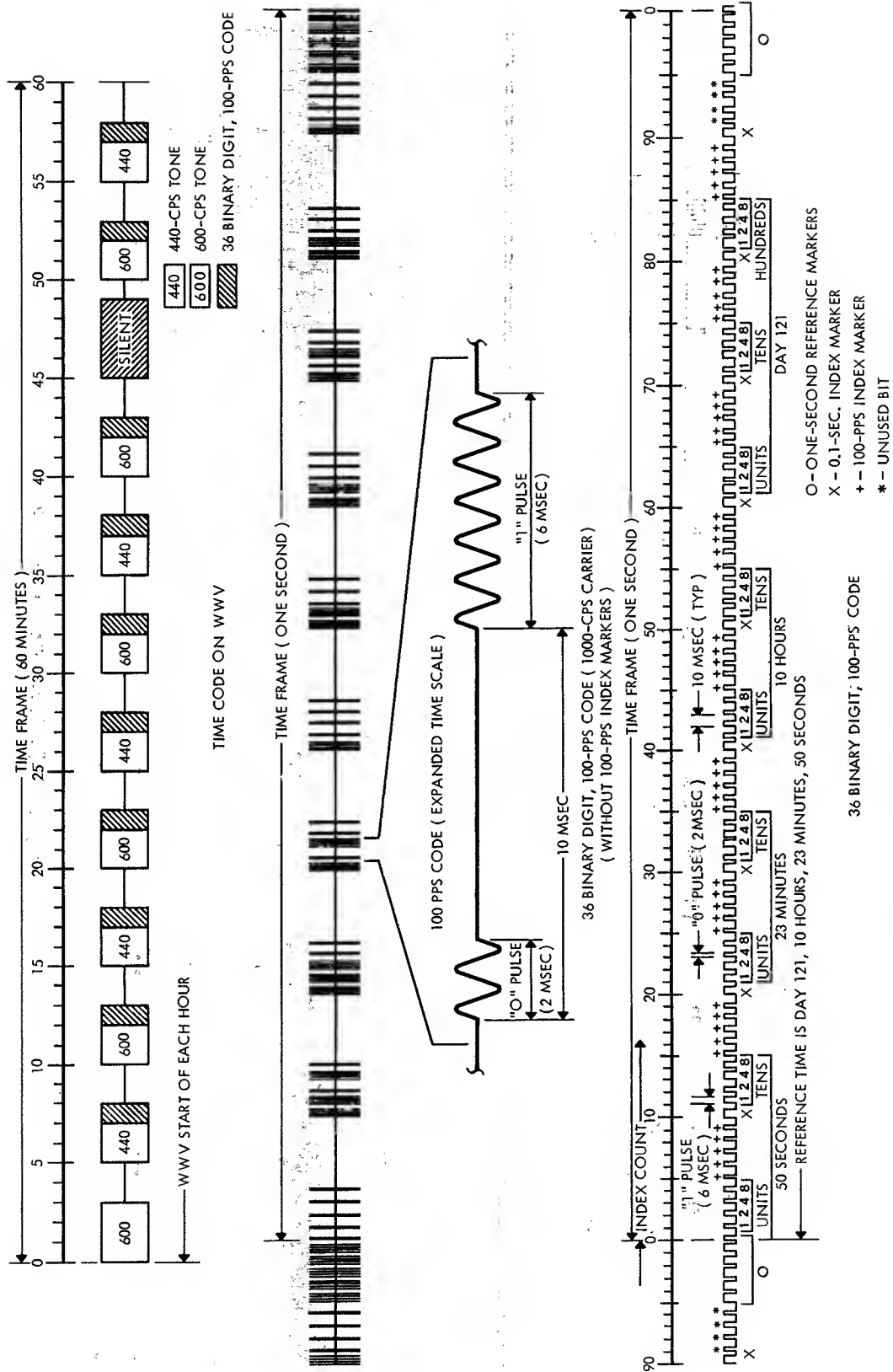


Figure 21 (Continued)-BCD, SD, WWV Time Code

## SECTION II. GROUND STATION OPERATIONS

### THE DATA-ACQUISITION STATIONS

Data telemetered from OGO-B will be recorded at the following data-acquisition stations. Those designated as primary are distinguished by their increased command capability, their real time data link with GSFC, and increased telemetry reception capability afforded by their 85-ft parabolic antennas. Otherwise, primary and secondary stations alike will acquire and record both PCM and Special Purpose telemetry from OGO. The general flow of data at the acquisition stations is indicated on Figure 23.

#### OGO-B TELEMETRY DATA ACQUISITION STATIONS

Station & Location	Letter Codes			No. Code	Command Capability	Real Time Data Link to GSFC	Support Function	Antenna
	1 Ltr	3 Ltrs	6 Ltrs					
Gilmore Creek, Alaska	T	SKA	ULASKA	19	Digital & Tone	Yes	Primary	85 ft Parabolic
Rosman, N. Carolina	U	ROS	ROSMAN	20	Digital & Tone	Yes	Primary	85 ft Parabolic
Johannesburg, U. of S. Africa	Q	JOB	JOBURG	16	Digital & Tone	None	Secondary	40 ft Parabolic
Quito, Ecuador	F	QUI	QUITOE	5	Digital & Tone	None	Secondary	40 ft Parabolic
Santiago, Chile	J	SNT	SNTAGO	8	Digital & Tone	None	Secondary	40 ft Parabolic
Winkfield, England	P	WNK	WNKFLD	15	Digital & Tone	None	Mobile	14 ft
ORORAL		ACT	ORORAL	21	Digital & Tone	None	Secondary	85 ft Parabolic
Darwin		DAR	DARWIN	21	Digital & Tone	None	Mobile	14 ft

Octal Number	Nomenclature	Octal Number	Nomenclature
<u>Digit</u>		<u>Digit</u>	
106	OPEP HTRS OFF	240	OPEP HTRS ON PC 2
107	EXP ORD ON	241	EP 1,2,3 HTRS ON PC 4
		242	EXP 2 MB & SOEP ON PC 6
110	EXP 1 SCALE IC 1	243	EXP 11 LAMP PC 6 ON
111	EXP 10 WH IC 5	244	EXP 3 SOEP ON PC 10
112	EXP 10 IFC OFF IC 9	245	EXP 5 ON PC 12
113	EXP 13 Go IC 13	246	EXP 6 ON PC 14
114	EXP 17 MOOE II IC 17	247	EXP 8 ON PC 16
115	EXP 2 SWITCH IC 21		
116	OPEP 2 UNCAGE IC 25	250	EXP 15 Vs PC 34 ON
117		251	EXP 15 Vs PC 36 ON
		252	EXP 15 ON PC 38
126	OPEP HTRS ON	253	EXP 17 ON PC 40
127	EXP ORD OFF	254	EXP 16 ANT OEPLY ON PC 42
		255	EXP 20 ON PC 44
130	EXP 10 SH IC 2	256	EXP 13 ON PC 46
131	EXP 10 WM IC 6		
133	EXP 13 Go IC 14	260	OPEP HTRS OFF PC 2
134	EXP 17 MOOE III, IC 16	261	EP 1,2,3 HTRS OFF PC 4
135	EXP 1 SCALE IC 22	262	EXP 2 MB & SOEP OFF PC 6
		263	EXP 11 LAMP PC 8 OFF
150	EXP 10 SM IC 3	264	EXP 3 SOEP OFF PC 10
151	EXP 10 WL IC 7	265	EXP 5 OFF PC 12
152	EXP 12 OEPLY IC 11	266	EXP 8 OFF PC 14
153	EXP 13 Go IC 15	267	EXP 8 OFF PC 18
154	EXP 17 MOOE III, IC 19		
155	OPEP-2 ENABLE IC 23	270	EXP 15 VS PC 34 OFF
		271	EXP 15 Vs PC 36 OFF
170	EXP 10 SL IC 4	272	EXP 15 OFF PC 38
171	EXP 10 IFC ON IC 8	273	EXP 17 OFF PC 40
172	EXP 13 Go IC 12	274	EXP 16 ANT OEPLY OFF PC 42
173	EXP 17 MOOE I IC 16	275	EXP 20 OFF PC 44
174	EXP 17 OEPLY IC 20	276	EXP 13 OFF PC 46
175	OPEP-2 DISABLE IC 24		
		300	EXP 9S ON PC 17
200	SOEP-1 HTR ON PC 1	301	EXP 9I ON PC 19
201	EP 4, HTRS ON PC 3	302	EXP 11 FG ON PC 21
202	EXP 1 ON PC 5	303	EXP 11 Rb A ON PC 23
203	EXP 2 OPEP ON PC 7	304	EXP 12 ON PC 25
204	EXP 3 MB ON PC 9	305	EXP 14 ON PC 27
205	EXP 4 ON PC 11	306	EXP 15 G1 PC 29 ON
206	EXP 5 EG 1 PC 13 ON	307	EXP 15 CAL PC 31 ON
207	EXP 7 ON PC 15		
		320	EXP 6S OFF PC 17
210	EXP 15 CAL PC 33 ON	321	EXP 9I OFF PC 19
211	EXP 15 Vs PC 35 ON	322	EXP 11 FG OFF PC 21
212	EXP 15 Vs PC 37 ON	323	EXP 11 Rb A OFF PC 23
213	EXP 16 ON PC 39	324	EXP 12 OFF PC 25
214	EXP 16 ON PC 41	325	EXP 14 OFF PC 27
215	EXP 19 ON PC 43	326	EXP 15 G1 PC 29 OFF
216	R & RR ON PC 45	327	EXP 15 CAL PC 31 OFF
217	OPEP-2 SCAN ON PC 47		
		341	EXP 10 ON PC 20
220	SOEP-1 HTR OFF PC 1	342	EXP 11 Rb B ON PC 22
221	EP 4, 5 HTRS OFF PC 3	343	EXP 11 PC 24 ON
222	EXP 1 OFF PC 5	344	EXP 13 ON PC 26
223	EXP 2 OPEP OFF PC 7	345	EXP 15 G1 PC 28 ON
224	EXP 3 MB OFF PC 9	346	EXP 15 CAL PC 30 ON
225	EXP 4 OFF PC 11	347	EXP 15 CAL PC 32 ON
226	EXP 5 EG 2 PC 13 OFF		
227	EXP 7 OFF PC 15	361	EXP 10 OFF PC 20
		362	EXP 11 Rb B OFF PC 22
230	EXP 15 CAL PC 33 OFF	363	EXP 11 PC 24 OFF
231	EXP 15 Vs PC 35 OFF	364	EXP 13 OFF PC 26
232	EXP 15 Vs PC 37 OFF	365	EXP 15 G1 PC 28 OFF
233	EXP 16 OFF PC 39	366	EXP 15 CAL PC 30 OFF
234	EXP 18 OFF PC 41	367	EXP 15 CAL PC 32 OFF
235	EXP 19 OFF PC 43		
236	R & RR OFF PC 45		
237	OPEP 2 SCAN OFF PC 47		

Figure 22-OGO-B Commands



# OGO - B COMMANDS

044/070

TCA 500

POWER									
316	REG 1	336	376	346	366	386	406	426	446
317	REG 2	337	377	347	367	387	407	427	447
318	REG 3	338	378	348	368	388	408	428	448
319	REG 4	339	379	349	369	389	409	429	449
320	REG 5	340	380	350	370	390	410	430	450
321	REG 6	341	381	351	371	391	411	431	451
322	REG 7	342	382	352	372	392	412	432	452
323	REG 8	343	383	353	373	393	413	433	453
324	REG 9	344	384	354	374	394	414	434	454
325	REG 10	345	385	355	375	395	415	435	455
326	REG 11	346	386	356	376	396	416	436	456
327	REG 12	347	387	357	377	397	417	437	457
328	REG 13	348	388	358	378	398	418	438	458
329	REG 14	349	389	359	379	399	419	439	459
330	REG 15	350	390	360	380	400	420	440	460
331	REG 16	351	391	361	381	401	421	441	461
332	REG 17	352	392	362	382	402	422	442	462
333	REG 18	353	393	363	383	403	423	443	463
334	REG 19	354	394	364	384	404	424	444	464
335	REG 20	355	395	365	385	405	425	445	465
336	REG 21	356	396	366	386	406	426	446	466
337	REG 22	357	397	367	387	407	427	447	467
338	REG 23	358	398	368	388	408	428	448	468
339	REG 24	359	399	369	389	409	429	449	469
340	REG 25	360	400	370	390	410	430	450	470
341	REG 26	361	401	371	391	411	431	451	471
342	REG 27	362	402	372	392	412	432	452	472
343	REG 28	363	403	373	393	413	433	453	473
344	REG 29	364	404	374	394	414	434	454	474
345	REG 30	365	405	375	395	415	435	455	475
346	REG 31	366	406	376	396	416	436	456	476
347	REG 32	367	407	377	397	417	437	457	477
348	REG 33	368	408	378	398	418	438	458	478
349	REG 34	369	409	379	399	419	439	459	479
350	REG 35	370	410	380	400	420	440	460	480
351	REG 36	371	411	381	401	421	441	461	481
352	REG 37	372	412	382	402	422	442	462	482
353	REG 38	373	413	383	403	423	443	463	483
354	REG 39	374	414	384	404	424	444	464	484
355	REG 40	375	415	385	405	425	445	465	485
356	REG 41	376	416	386	406	426	446	466	486
357	REG 42	377	417	387	407	427	447	467	487
358	REG 43	378	418	388	408	428	448	468	488
359	REG 44	379	419	389	409	429	449	469	489
360	REG 45	380	420	390	410	430	450	470	490
361	REG 46	381	421	391	411	431	451	471	491
362	REG 47	382	422	392	412	432	452	472	492
363	REG 48	383	423	393	413	433	453	473	493
364	REG 49	384	424	394	414	434	454	474	494
365	REG 50	385	425	395	415	435	455	475	495
366	REG 51	386	426	396	416	436	456	476	496
367	REG 52	387	427	397	417	437	457	477	497
368	REG 53	388	428	398	418	438	458	478	498
369	REG 54	389	429	399	419	439	459	479	499
370	REG 55	390	430	400	420	440	460	480	500
371	REG 56	391	431	401	421	441	461	481	501
372	REG 57	392	432	402	422	442	462	482	502
373	REG 58	393	433	403	423	443	463	483	503
374	REG 59	394	434	404	424	444	464	484	504
375	REG 60	395	435	405	425	445	465	485	505
376	REG 61	396	436	406	426	446	466	486	506
377	REG 62	397	437	407	427	447	467	487	507
378	REG 63	398	438	408	428	448	468	488	508
379	REG 64	399	439	409	429	449	469	489	509
380	REG 65	400	440	410	430	450	470	490	510
381	REG 66	401	441	411	431	451	471	491	511
382	REG 67	402	442	412	432	452	472	492	512
383	REG 68	403	443	413	433	453	473	493	513
384	REG 69	404	444	414	434	454	474	494	514
385	REG 70	405	445	415	435	455	475	495	515
386	REG 71	406	446	416	436	456	476	496	516
387	REG 72	407	447	417	437	457	477	497	517
388	REG 73	408	448	418	438	458	478	498	518
389	REG 74	409	449	419	439	459	479	499	519
390	REG 75	410	450	420	440	460	480	500	520
391	REG 76	411	451	421	441	461	481	501	521
392	REG 77	412	452	422	442	462	482	502	522
393	REG 78	413	453	423	443	463	483	503	523
394	REG 79	414	454	424	444	464	484	504	524
395	REG 80	415	455	425	445	465	485	505	525
396	REG 81	416	456	426	446	466	486	506	526
397	REG 82	417	457	427	447	467	487	507	527
398	REG 83	418	458	428	448	468	488	508	528
399	REG 84	419	459	429	449	469	489	509	529
400	REG 85	420	460	430	450	470	490	510	530
401	REG 86	421	461	431	451	471	491	511	531
402	REG 87	422	462	432	452	472	492	512	532
403	REG 88	423	463	433	453	473	493	513	533
404	REG 89	424	464	434	454	474	494	514	534
405	REG 90	425	465	435	455	475	495	515	535
406	REG 91	426	466	436	456	476	496	516	536
407	REG 92	427	467	437	457	477	497	517	537
408	REG 93	428	468	438	458	478	498	518	538
409	REG 94	429	469	439	459	479	499	519	539
410	REG 95	430	470	440	460	480	500	520	540
411	REG 96	431	471	441	461	481	501	521	541
412	REG 97	432	472	442	462	482	502	522	542
413	REG 98	433	473	443	463	483	503	523	543
414	REG 99	434	474	444	464	484	504	524	544
415	REG 100	435	475	445	465	485	505	525	545
416	REG 101	436	476	446	466	486	506	526	546
417	REG 102	437	477	447	467	487	507	527	547
418	REG 103	438	478	448	468	488	508	528	548
419	REG 104	439	479	449	469	489	509	529	549
420	REG 105	440	480	450	470	490	510	530	550
421	REG 106	441	481	451	471	491	511	531	551
422	REG 107	442	482	452	472	492	512	532	552
423	REG 108	443	483	453	473	493	513	533	553
424	REG 109	444	484	454	474	494	514	534	554
425	REG 110	445	485	455	475	495	515	535	555
426	REG 111	446	486	456	476	496	516	536	556
427	REG 112	447	487	457	477	497	517	537	557
428	REG 113	448	488	458	478	498	518	538	558
429	REG 114	449	489	459	479	499	519	539	559
430	REG 115	450	490	460	480	500	520	540	560
431	REG 116	451	491	461	481	501	521	541	561
432	REG 117	452	492	462	482	502	522	542	562
433	REG 118	453	493	463	483	503	523	543	563
434	REG 119	454	494	464	484	504	524	544	564
435	REG 120	455	495	465	485	505	525	545	565
436	REG 121	456	496	466	486	506	526	546	566
437	REG 122	457	497	467	487	507	527	547	567
438	REG 123	458	498	468	488	508	528	548	568
439	REG 124	459	499	469	489	509	529	549	569
440	REG 125	460	500	470	490	510	530	550	570
441	REG 126	461	501	471	491	511	531	551	571
442	REG 127	462	502	472	492	512	532	552	572
443	REG 128	463	503	473	493	513	533	553	573
444	REG 129	464	504	474	494	514	534	554	574
445	REG 130	465	505	475	495	515	535	555	575
446	REG 131	466	506	476	496	516	536	556	576
447	REG 132	467	507	477	497	517	537	557	577
448	REG 133	468	508	478	498	518	538	558	578
449	REG 134	469	509	479	499	519	539	559	579
450	REG 135	470	510	480	500	520	540	560	580
451	REG 136	471	511	481	501	521	541	561	581
452	REG 137	472	512	482	502	522	542	562	582
453	REG 138	473	513	483	503	523	543	563	583
454	REG 139	474	514	484	504	524	544	564	584

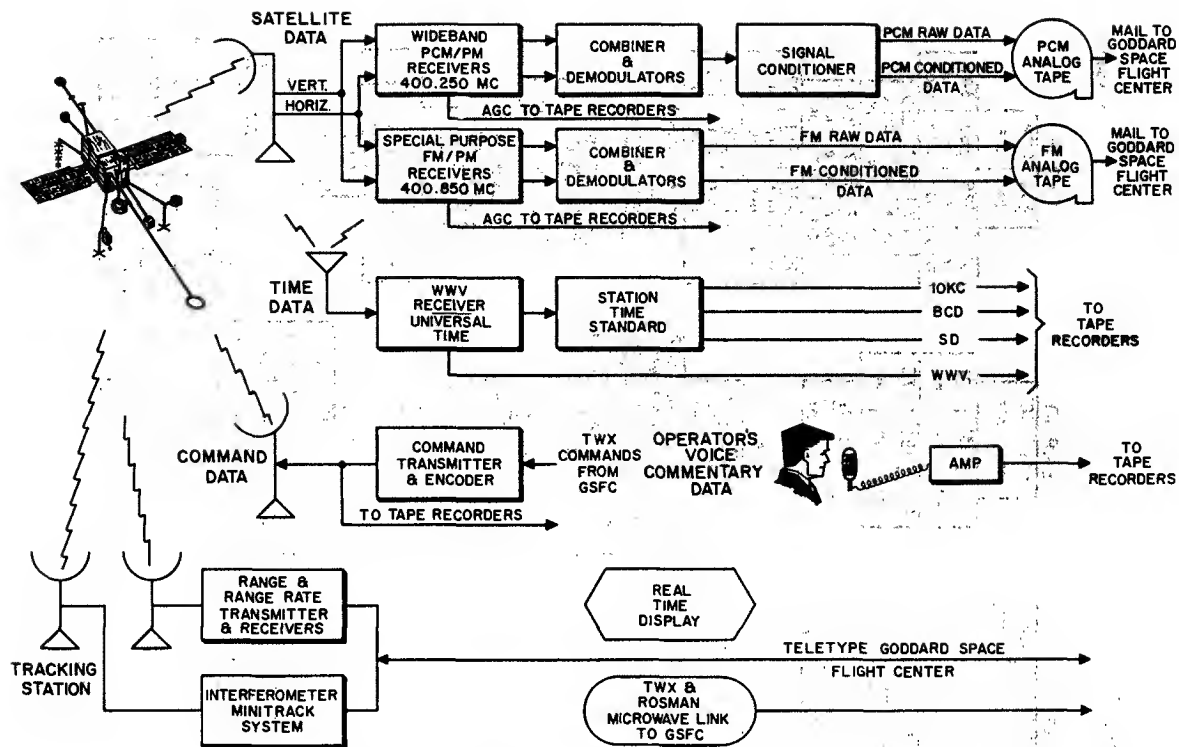


Figure 23--Flow Chart of Data at Stations

## DATA ACQUISITION OPERATIONS

### PCM/PM Data

a. Analog Tape Track assignments for PCM/PM data are as follows:

Track	Record Amplifier	Source	Signal
1	Direct	Multiplex System	Receiver AGC's and 10kc
2	Direct	Transmitter Control Panel	Commands
3	Direct	Diversity Combiner	Unconditioned PCM Data
4	Direct	Time Standard System	BCD Time Code
5	Direct	PCM-DHE	Conditioned PCM Data
6	FM	Time Standard System	Serial Decimal Time Code
7	Direct	Audio Amplifier	Voice Commentary & WWV Time

Formats of the BCD, Serial Decimal and WWV Time Codes appear as Figure 17.

Commands and PCM data are discussed further in Section III. OGO-B commands, their octal codes, and their actions are also displayed on Figure 22.

b. Recording procedures are as follows:

Ampex FR-607 tape recorders will be used at the data acquisition stations. All data will be recorded using 14 inch reels. Tape length will be 4800 ft, tape width will be 1/2 inch, and tape thickness 1-1/2 mils.

Playback data will be recorded on 14 inch reels so that an entire dump can be recorded on one tape.

Recording duration and tape speeds for the varied modes and bit rate of PCM data are as follows:

<u>Mode &amp; Bit Rate</u>	<u>Maximum Recording Duration</u>	<u>Tape Speed</u>	<u>Reel Size</u>
1 Kilobit Real Time	112 minutes	7-1/2 ips	14
8 Kilobit Real Time	112 minutes	7-1/2 ips	14
64 Kilobit Real Time	28 minutes	30 ips	14
64 Kilobit Playback	28 minutes	30 ips	14

Additional PCM recording requirements are as follows. Playback data will be recorded on a different tape from real time data. There shall be no more than one pass per tape for any of the four categories of data enumerated above. When a recording period terminates prior to the end of a tape, no further recording from following passes will be made on that tape.

c. Mailing procedures are as follows. All recorded station tapes will be airmailed with accompanying tape logs, to the following address:

Analog Tape Library  
Code 564,  
Goddard Space Flight Center,  
Greenbelt, Maryland, U.S.A.

### FM/PM Special Purpose Data

a. Analog tape track assignments for FM/PM data are as follows:

Track	Record Amplifier	Source	Signal
1	Direct	Time Standard System & Multiplexed System	Receiver AGC's & 10 kc Reference
2	Direct	Transmitter Control Panel	Commands
3	Direct	Diversity Combiner	FM Data
4	Direct	Time Standard System	BCD Time Code
5	Direct	Time Standard System	100 kc Reference
6	FM	Time Standard System	Serial Decimal Time Code
7	Direct	Audio Amplifier	Voice Commentary & WWV Time

Formats of the BCD, Serial Decimal and WWV Time Codes appear as Figure 21.

Commands are discussed in Section III and FM Data experimenter bandwidth assignments in Section IV

b. Recording procedures are as follows:

Ampex FR-607 tape-recorders will be used and the FM data will be recorded using 10-1/2 inch reels. Tape length will be 2400 ft., tape width will be 1/2 inch, and tape thickness 1-1/2 mil.

Tape speed for recording of FM data will be 30 ips, with the maximum duration of recording set at 14 minutes. Recording will be done on the basis of one pass per tape. When a recording period terminates prior to the end of a tape, no further recording from following passes will be made on that tape.

c. Mailing procedures are as follows. All recorded station tapes will be airmailed with accompanying tape logs, to the following address:

Analog Tape Library  
Code 564  
Goddard Space Flight Center,  
Greenbelt, Maryland, U.S.A.

Common PCM/PM and FM/PM Considerations

Figure 24 shows the Magnetic Tape Log form which will accompany each EGO analog station tape mailed to the Data Processing Branch. The Log will indicate whether data on the tape is PCM or FM, the recording tape speed, and for PCM data, the bit-rate. The Data Acquisition stations will also indicate on the Log certain additional information about the recorded data when such information is readily obtainable at the station. This information will be indicated by letter code affixed to the logged analog tape number and will distinguish the following types of data in the manner given below.

<u>Letter Code</u>	<u>Definition</u>
C	Tape Contains Commands Only
A	Tape Contains PCM Accelerated Subcom data only
R	Tape Contains PCM Real time Data only
P	Tape Contains PCM Playback Data only

Date _____	Station Name _____ No. _____
Satellite(s) Name _____	Geodetic Coordinates _____
Tape No. _____	Latitude _____
Make Recorder _____	Longitude _____
Model _____ Serial No. _____	

[illegible]

TAPE SPEED	D - Direct	NOT REWOUND	MAILED TO:
	P - Pulse Width		
	F - FM		
	C - Control Track		
I.P.S.	N - Non-return-to-zero		

Cumulative Msg. DTG.

[illegible]

EQUIPMENT PARAMETERS		OPERATIONS PARAMETERS	
1		1	
2		2	
3		3	
4		4	

Figure 24—Ground Station Magnetic Tape Lag

## SECTION III. PROCESSING SYSTEMS

The data processing methods, computer programs, hardware systems, and processing controls used for OGO are outlined below. Operational use of these facilities as they are employed during Launch Back-Up and Post-Launch operations, during Quick Look Passes, and for Normal Production processing, is outlined in Section IV, "Data Processing Operations."

### A. PCM PROCESSING

Processing of PCM data for OGO-B is divided among three successive phases: analog/digital conversion, edit-quality control, and decommutation. These phases are augmented by concurrent processing of spacecraft commands and generation of spacecraft attitude-orbit tapes. Each are outlined below.

## 1. Processing Control

Control of production processing, and monitoring of production quality are vested in two groups, the Production Control Group and Quality Control Group, respectively (Figure 25).

Production Control Personnel - Production Control Personnel are responsible for scheduling the analog/digital conversion of PCM data, for scheduling

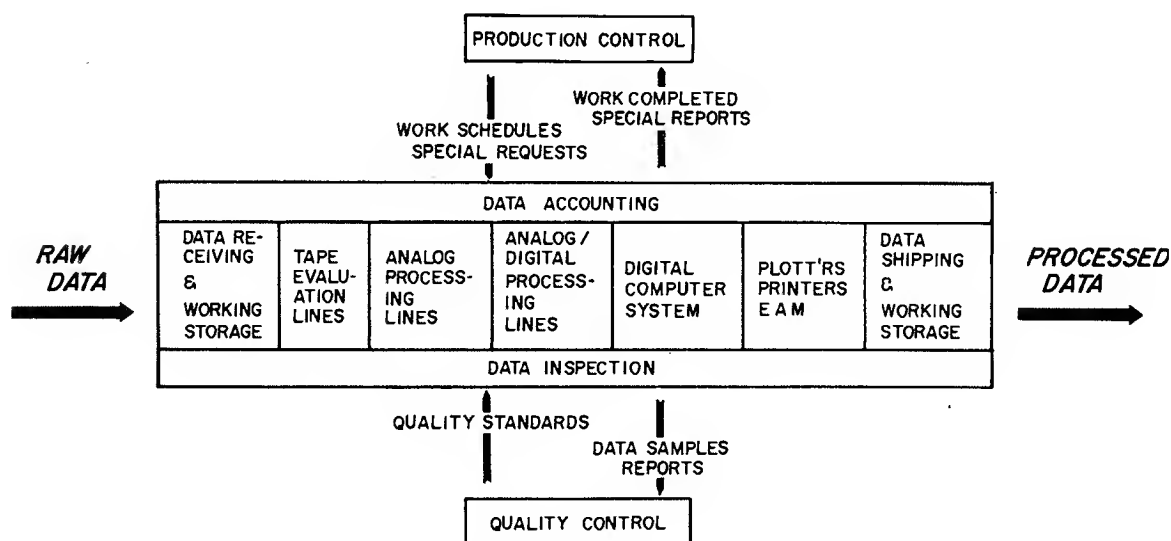


Figure 25–Production Flow & Control Chart

editing, decommutation, and quality checks by the Quality Control Group. Production Control also generates, records, and reports the accounting information required for the efficient monitoring and production processing of OGO data. In addition these personnel schedule the processed data for shipment and assure that these are accompanied by the proper shipping documents. Production Control personnel also schedule and monitor the operations necessary for processing spacecraft commands, the OGO-B attitude-orbit tape, and subsystem data processing.

Quality Control Personnel - Quality Control Personnel are responsible for monitoring the accuracy and validity of PCM data as reported by the edit and quality control program. Based on their scrutiny of various quality indicators, Quality Control personnel make the decision to release edited data for decommutation, to submit data for re-digitizing and/or re-editing, or to reject it as unprocessable. The Quality Control group is responsible for monitoring output of the decommutation program to assure that data files have been processed in chronological order on a run and that time intervals of output data files are non-overlapping. The Quality Control group also monitors the processing of spacecraft commands recorded on the ground station analog tapes and checks these with commands recorded at the OGO Control Center to assure that only valid commands are processed and dispatched to experimenters.

## 2. Processing System

The OGO-B PCM data processing system is outlined below functionally and nearly in the chronological order in which data is processed. Specific applications of each function during various operational modes are described further in Section IV, "Data Processing Operations."

### Analog Tape Acquisition and Handling -

Tape receipt. Upon receipt, magnetic tapes from the ground stations will be placed in the analog tape library. The information contained on the station log sheet will be punched into an analog card (see Figure 38). A chronological listing (Figure 56) based on both analog and digital cards will be produced monthly to indicate the status of processing of data received. These lists will be sent to the OGO Project Manager, to the EGO Project Scientist, to all OGO-B experimenters, and to Production Control. In addition to the monthly listing, Production Control will receive a weekly progress report.

Tape evaluation. From shipments received, tapes recorded by each station will be evaluated for recording technique and conformity to standards by the Tape Evaluation Group (Figure 26 shows one of the tape evaluation stations).



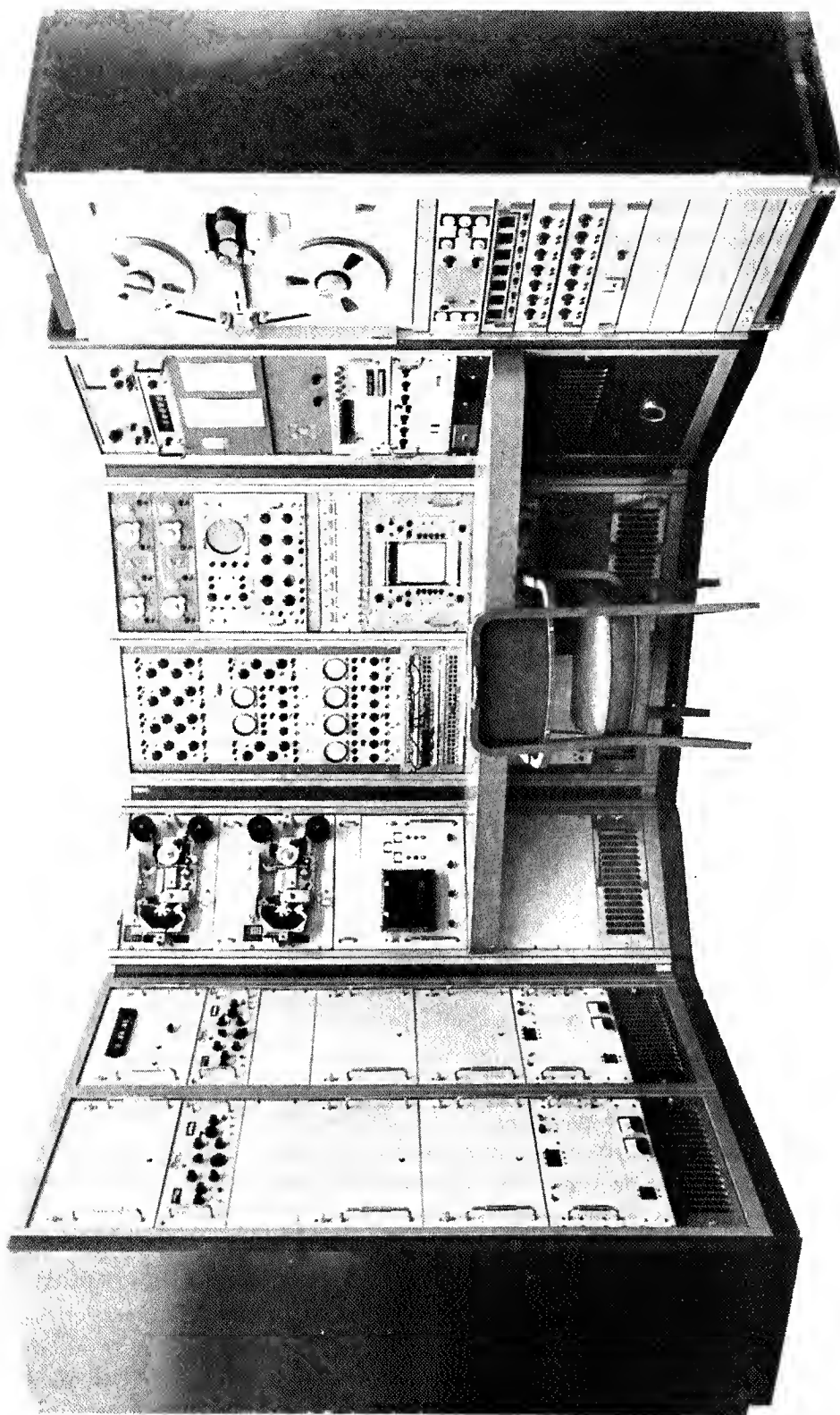


Figure 26—Tape Evaluation Line

The Network Operations Branch of the Network Engineering and Operations Division will be notified immediately of any gross anomalies detected. All stations will be rated in a report sent to the head of the Operations Branch, Operations and Support Division.

Tape storage. Analog tapes will be stored in the Central Processing Facility, GSFC, until the data contained on them have been processed. One month after the processed data are released to the experimenters the analog tapes will be sent to the Federal Archives for dead storage.

#### Analog-to-Digital Conversion -

The processing line. Analog tapes with tracks as described in Section II, "Data Acquisition Operations," must be converted into a digital format for digital computer processing (see Figure 27 for schematic, Figure 28 for appearance of processing line). The signal from a data track is fed into the PCM signal processor where the waveform is reconditioned. Figure 29 gives the format of a frame of analog data, and Figure 30 shows the PCM sequence of S/C word 1 as they are encountered during this phase. After bit synchronization is established in the bit synchronizer, the search is begun for the 27-bit frame-sync word. After a 27-bit word conforming to the expected sync word is found, it must be verified by appearing 3 consecutive times in the proper location with no more than 2 bit errors per sync pattern. The proper location within the frame is decided by starting the word counter assuming the first appearance of the sync word to be correct. If the 27-bit word is found at some location other than the expected one, the process is repeated using the most recently located 27-bit word as the starting point. Once frame sync is established, buffer records corresponding to 8 TM frames, 45 36-bit wide per frame, are written. Both time codes (binary-coded decimal and serial decimal, tracks 4 and 5 respectively) are decoded. A calibrated tracking oscillator is used to update the accumulator which in turn is compared periodically against both time standards. The input to this oscillator is a 10-kc reference frequency recorded on track 1. An elaborate system of flags is generated by the line which, when properly analyzed, indicates the quality of the time recorded on the buffer tape. (These flags are used in the quality control and edit program to facilitate the time computation.) In addition to generation of the buffer tape, the processing line decodes spacecraft commands recorded on track 2 of the analog tape and punches commands and associated times on paper tape for further processing. Additional special handling is required in the analog-to-digital conversion of tape-recorder playback data. During tape-recorder "dumps" the data is in a reversed time-sequence when it is telemetered to the ground and recorded. In order to obtain the telemetry words and bits in their proper time sequence, an analog tape containing playback data, unlike one of real time data, must be physically "turned over" prior to digitization.

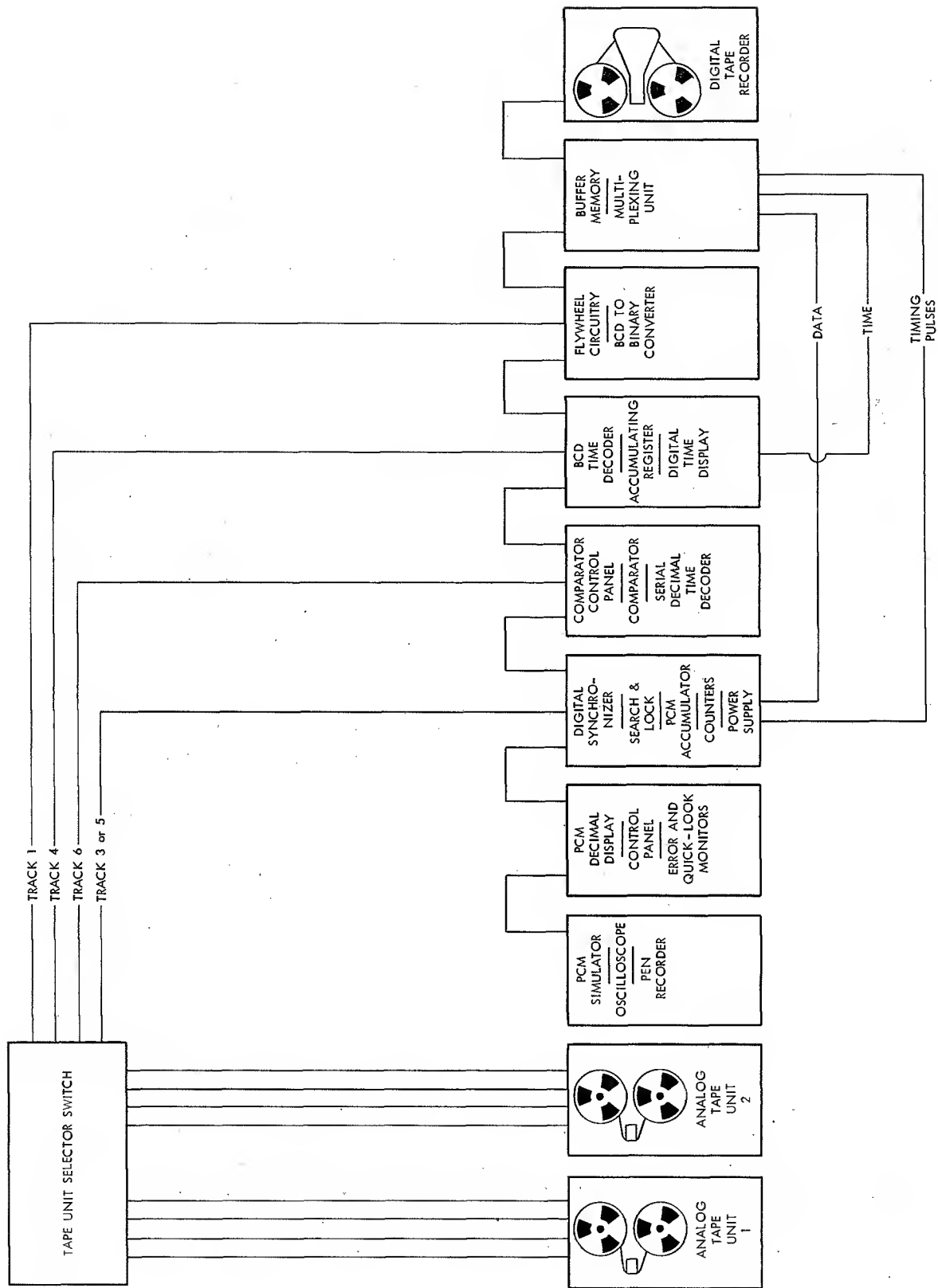


Figure 27 -A/D Processing Line

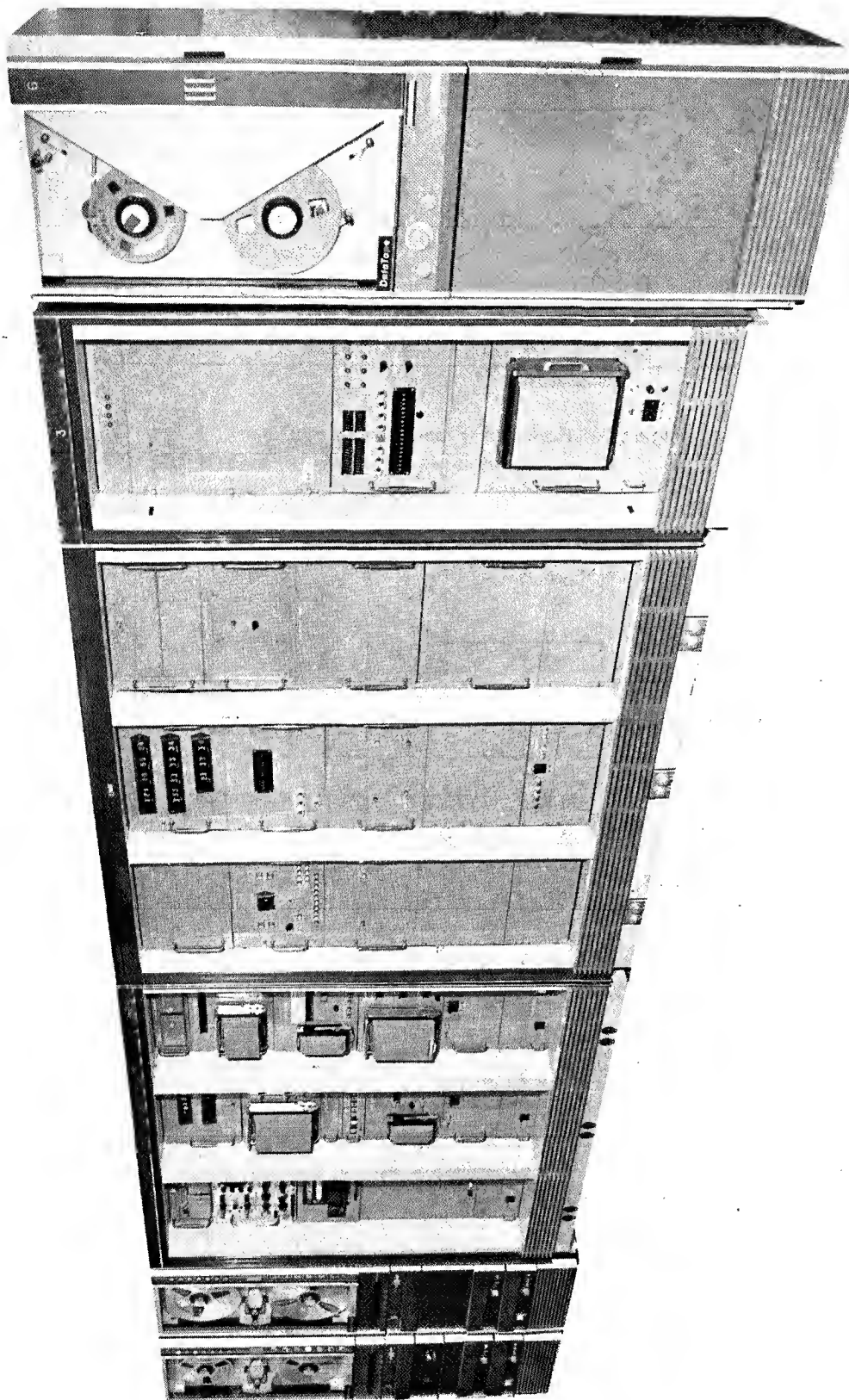


Figure 28-A/D Processing Line

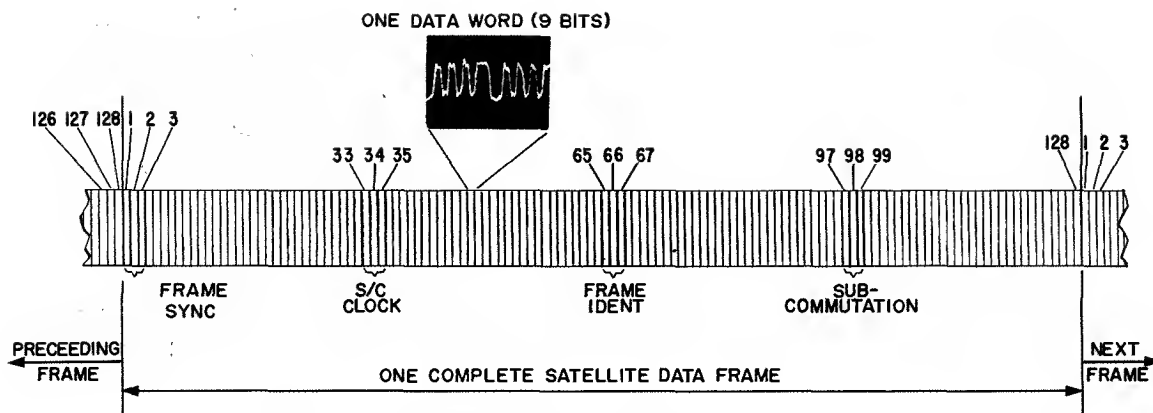


Figure 29-Format of Frame of Analog Data

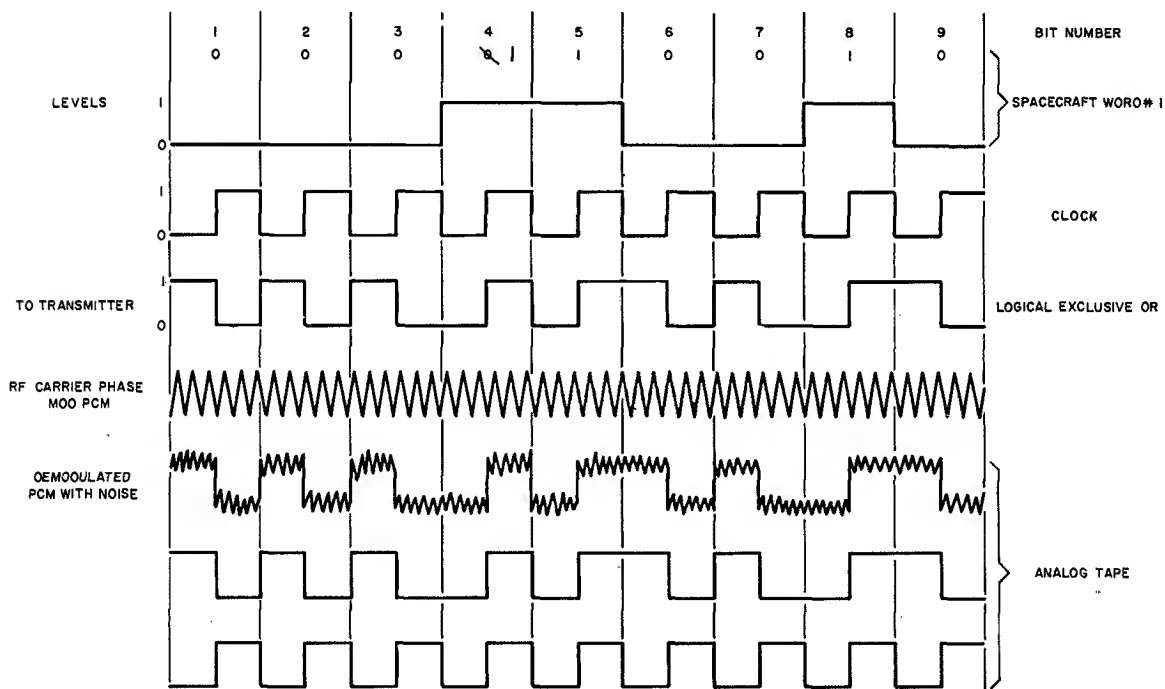


Figure 30-PCM Sequence of S/C Word 1

Formats of the buffer tape generated during analog-to-digital conversion appear as Figures 31 and 32. The format of a buffer tape record is given on Figure 34. Each buffer frame consists of 270 characters, of which 256 are allotted to the 128 words of the telemetry frame. Of the remaining characters, six are reserved as status flag fields for the frame, two are reserved for the day of year, and six for the milliseconds of day of the frame.

Intermediate Digital Computer Processing - Intermediate processing of PCM data, using as general input the buffer tapes generated during A/D conversion, consists of extensive editing, quality control and time correction using



Figure 31-Format of Buffer Tape

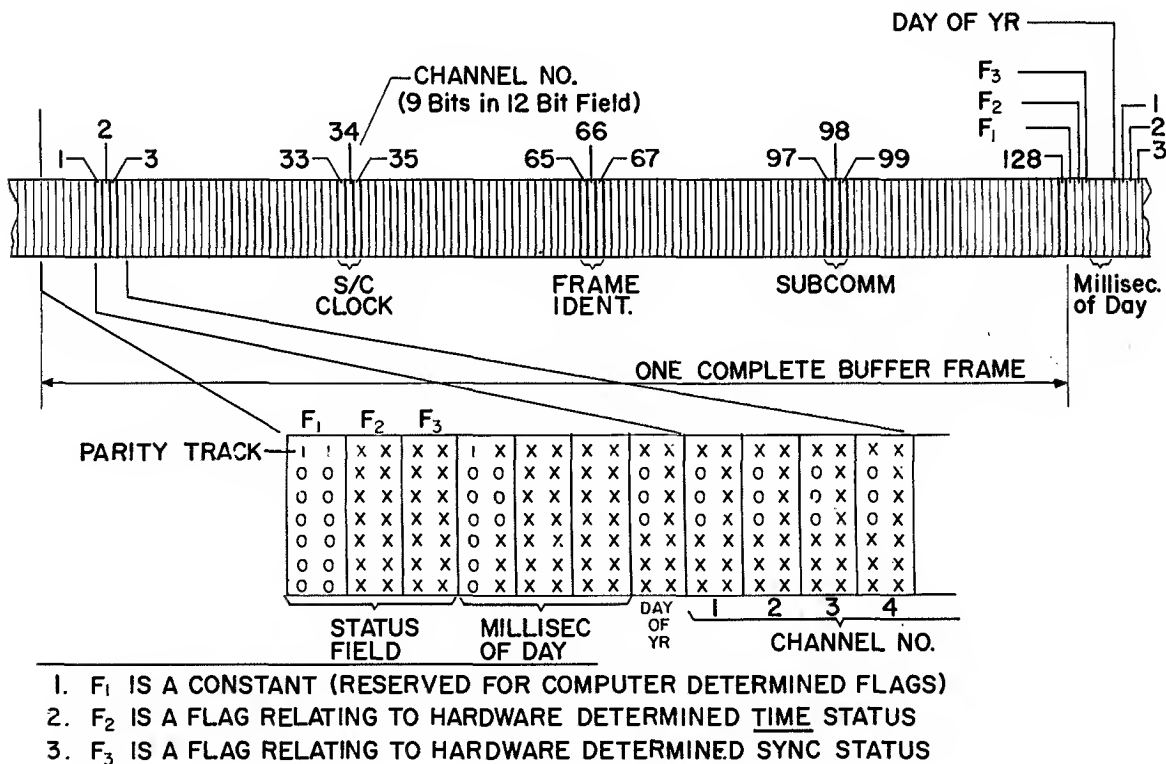


Figure 32-Format of Buffer Data

Buffer ID Record 1

Character	Information
1-4	Buffer tape number
5-6	Year of digitization
7-9	Day of digitization
10-11	A/D operator ID
12-13	A/D line used
14-18	Blank

Buffer ID Record 2

Character	Information
1-5	Satellite Identification
6-7	Year of recording
8-10	Station number
11-14	Analog tape number
15-16	Analog file number
17-18	Blank

Figure 33—Buffer ID Format

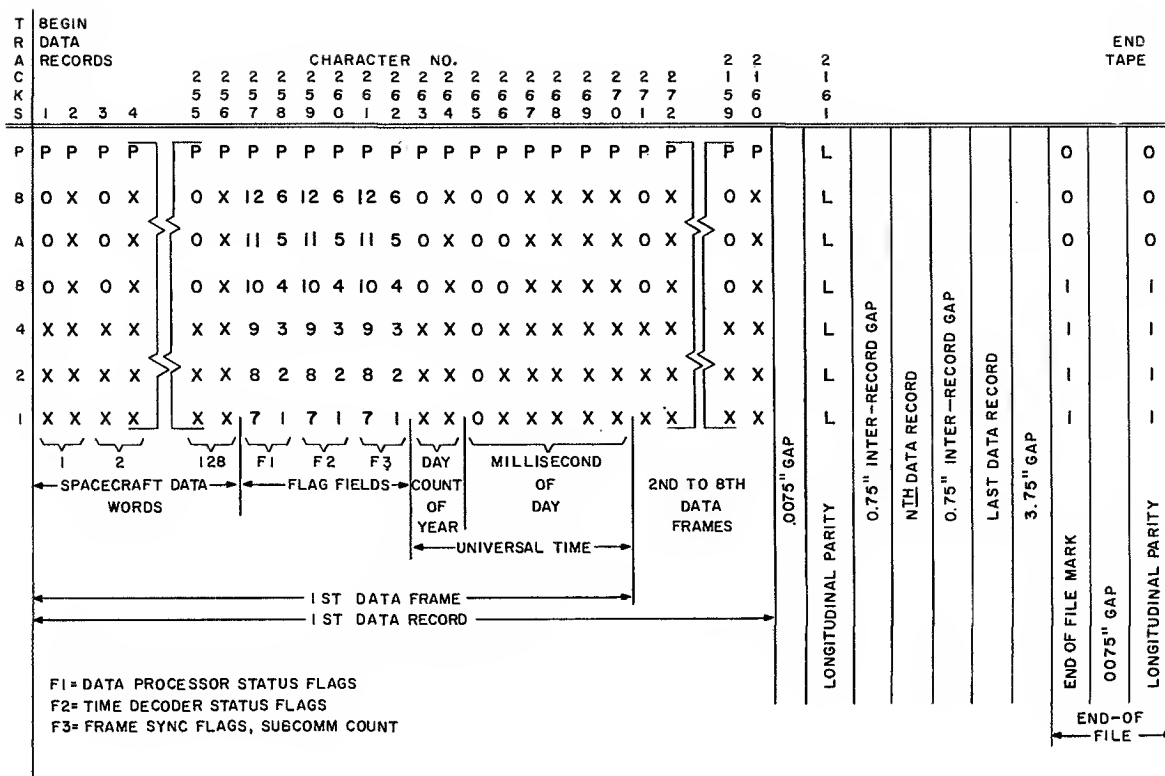


Figure 34—Format of Buffer Tape Record

the UNIVAC 1107 digital computer (Figure 35). For tape-recorder playback data the processing also includes an initial and essential reformatting. The intermediate stage processing is further described below.

Playback Reformat and Time Correction - The Reformat and Time Correction Program is used solely for playback data and as a stage in processing is a necessary antecedent to editing, quality control and time correction functions performed in the edit phase. Reformatting of playback data consists of proper chronological ordering of segments of playback data on the buffer tape. The initial disarray of playback data segments on a buffer tape stems from the data being dumped serially from two spacecraft tape recorders (reference Figure 36). Determination of a data segment in the program depends on an accurate identification and verification in the data of apparent "backward" jumps in the spacecraft block. After being reformatted, playback data is written in the proper chronological order on a new "buffer" tape and is now amenable to editing, quality control, and time correction functions of the Edit Program.



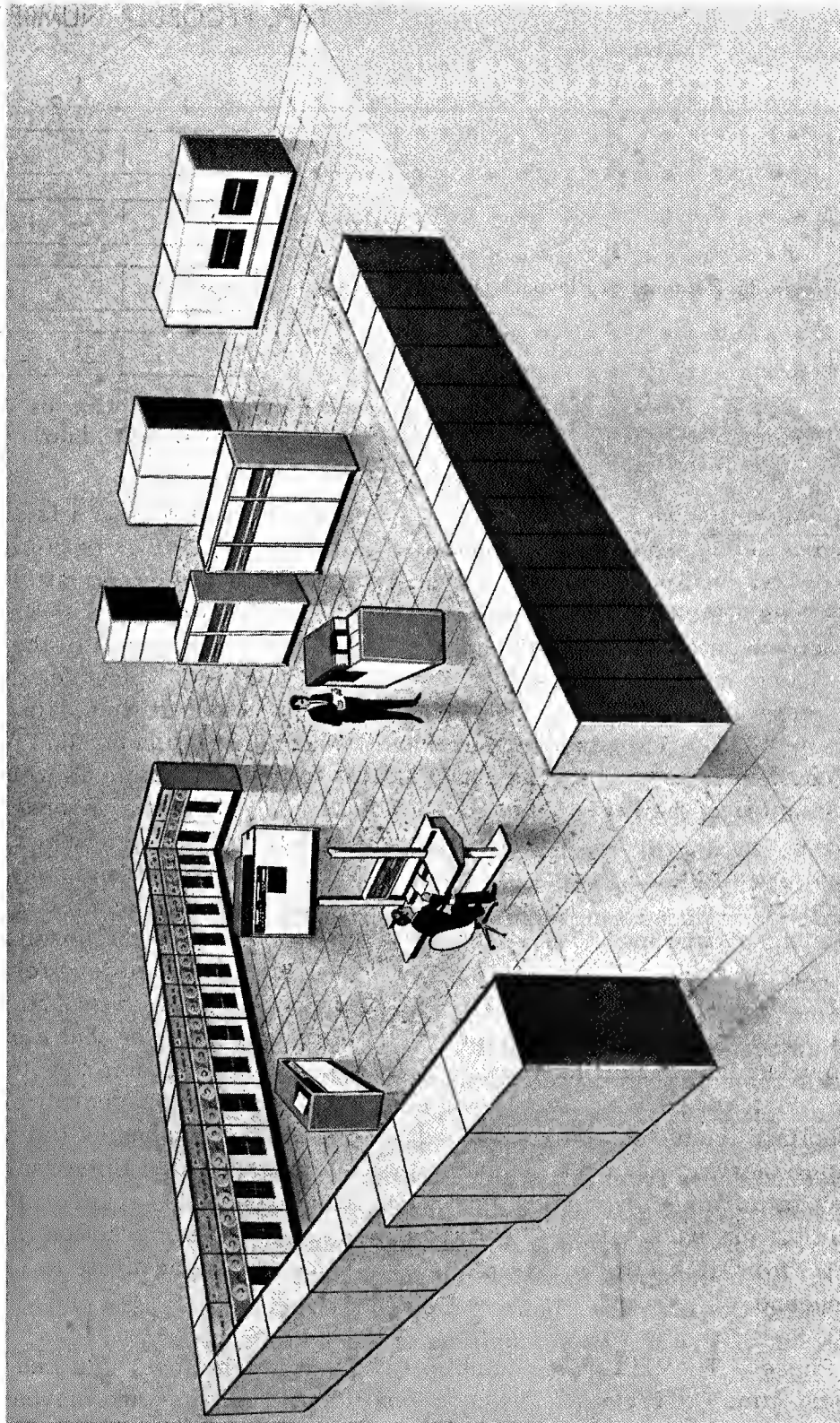


Figure 35—Univac 1107 Digital Computer

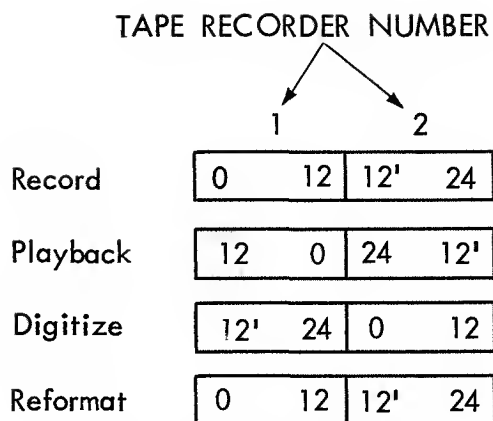


Figure 36—Reformat of Playback Data

where numbers within boxes  
represent real time of data.

Time correction which occurs in the playback reformat program is an optional feature to be used during reformatting and in lieu of Edit Program time correction when certain spacecraft clock conditions required by the latter are not met or when Quick Look is in vogue. The rule will be that Normal Production data will only be reformatted, with time correction in this case left to the edit program. In general, time correction when applied to OGO-B playback data alludes to more extensive processing than when applied to real time data. Time correction applied to real time data involves the transformation of GMT time recorded on the analog tape at the ground station to the GMT time as which the data was sampled in the S/C. Time correction as applied to tape recorder playback data entails not only a transformation to Universal Time, but must also take into account that ground station GMT time as recorded on an analog tape of playback data is unusable. The fact that the playback data is telemetered and recorded at the ground station in reversed time sequence, plus the possibility that it may have reposed in data storage on spacecraft tape recorders for some time before a dump, jointly afford no easy direct correlation with ground station time. The Playback Reformat Program time correction requires that a buffer tape of playback data be accompanied to the computer by a console key-in (Figure 32) of a matched pair of times. One is a high-resolution spacecraft clock reading obtained from Real Time data and the other a corresponding Universal Time. Using these as input the computer then ascribes updated Universal Times to playback data frames by making use of the higher resolution spacecraft clock readings in the playback data. When the above "raw" time correction is employed (e.g., for Quick Look data) time of any frame will be accurate to less than one second.

Edit Phase — The Edit phase combines two prime functions, Edit and Quality Control, and Time Correction. These are applied to real time and playback data alike.

```

RUN 09:12:27
PLM,109,5000,5000
MSG:
LOG NUMBER 074
MOUNT PROG
-CR1 TERMINATED
AR 6/2 PROG
MOUNT INPUT
AR 4/10,11 INPUT
MOUNT OUTPUT
AR 5/0,1,2,3 OUTPUT
KEY IN-TOTAL NUMBER OF PLAYBACK TAPES TO BE PROCESSED
2

```

```

OPERATOR TYPE 1ST S/C TIME (OCTAL)
135043551

```

```

OPERATOR TYPE UNIVERSAL TIME (DECIMAL)
31107836

```

```

DAY COUNT MUST BE 3 CHARACTERS LEADING ZEROS WHEN NECESSARY
DAY COUNT OF YEAR (DEC)
094

```

```

INPUT TAPE IDENTIFICATION
BUFFER TAPE NUMBER      0060
ANALOG TAPE NUMBER      0006
END RUN 09:17:38

```

Figure 37-Playback Time Correction Console Key-In

Edit Program - The Edit Program produces edit tapes which contain files of data in chronological order, the order being independent of the ground station of recording. The one ordering constraint is that playback data and real time data files never appear together on an output tape. In practice, playback edit runs on the computer are made separate from runs for real time data.

To produce edit tapes with files in chronological order, the input buffer tapes must be called for in proper order. To assure this the computer compares the chronologically arranged analog cards (Figure 38) with the internal file label of each buffer tape. In addition to its time-ordering use, the analog card is compared with the remaining portions of the buffer file label, and both are written as part of the edit file label record (format given in Figure 39).

1		
2	SATELLITE	
3		
4		
5	STATION	
6		
7		
8	*	
9		
10	ANALOG TAPE	
11		
12		
13		
14	YEAR	DATE OF RECORDING
15	MONTH	
16	DAY	
17		
18	*	
19		
20		
21	PASS	
22		
23		
24		
25	(UNUSED)	
26		
27		
28		
29		
30	*	
31		
32		
33		
34	HOURS	ANALOG START TIME
35	MINUTES	
36	SECONDS	
37		
38	*	
39		
40	HOURS	ANALOG STOP TIME
41	MINUTES	
42	SECONDS	
43		
44	*	
45		
46		
47		
48	**	DATE RECEIVED
49	MONTH	
50	DAY	
51		
52		
53		
54	EVALUATION CODE	
55	*	
56		
57	**	DATE EVALUATED
58	MONTH	
59	DAY	
60		
61		
62	*	
63	**	DATE CONVERTED
64	MONTH	
65	DAY	
66		
67		
68	CONVERSION LINE	
69		
70		
71	DATE STORED	
72		
73		
74		
75		
76	LOCATION OF TAPE	
77		
78	ANALOG FILE NUMBER	
79		
80	1	

← DATA RATE  
 ← TYPE OF DATA  
 ← REDUNDANCY CODE  
 ← LAST FILE ON ANALOG TAPE  
 ← CARD IDENTIFICATION SYMBOL

\* UNUSED COLUMNS  
 \*\* YEAR OF DECADE

Figure 38--Analog Card Format

# Label (ID) Record for OGO-B, Master Binary Tape and all Experimenters Decomm Tapes

The first record per file is called the Label record. It serves as a means to identify the data contained on that file of which it is a part. Each record will contain 120 six-bit characters in a form suitable for direct printing.

The format of the Label record is as follows:

Character	Representation
1-5+Space	Satellite Identification (assigned after launch) Example: 65021 where: 65 = year of launch 02 = Beta 1 = object
7-8+Space	Year
10-12+Space	Station Number Example 001 = Blossam Point 020 = Rosman
14-15+Space	Analog File Number
17-20+Space	Analog Tape Number
22-23+Space	Buffer File Number
25-28+Space	Buffer Tape Number
30-32+Space	Date of data digitization (day of year)
34-66	Will be identical to character 1-33 unless an error was found in those characters. If that is the case, then this portion of the record will contain the corrected values of that field.
67+Space	Type of data contained in file 0 = 4 kilobit real time 1 = 16 kilobit real time 2 = 64 kilobit real time 3 = command storage playback
69-71+Space	Day of year
73-77+Space	Seconds of day      start time of data
79+Space	Is Flexible Format in use?      1 = Yes 0 = No
81-82	Flexible Format Number
83-88	Blank
89+Space	Equipment Group in use (1 or 2)
91-94+Space	Master Binary Tape Number
96-97+Space	Master Binary File Number
99-100+Space	A/D line operator ID
102-103	A/D line ID
104-113	Blank
114-115	Reel Sequence Number
116-118	Run Number
119-120	Experiment Number

Figure 39--Edit & Decomm Label Record Format

Disagreement between the analog card and the buffer file label is indicated on an edit listing (Figure 46) and the contents of the analog card are accepted as the correct identification of the input buffer file.

In processing the buffer tape the computer accepts the 8-frame buffer records and reformats them into 128-frame edit records, corresponding to one cycle of the spacecraft subcommutators. It adds a special frame to the 128 data frames so the edit record actually carries a total of 129 frames (Figure 40). Label records are carried over from the buffer format to the edit format but are modified and added to by the program.

Each 8-frame buffer record is inspected for format errors. This includes verifying the proper word, frame and record lengths. Each buffer frame is also tested for bit slippage in the frame sync word. When detected, the frame is "shifted" back to its appropriate bit positions. A record of bit slippage corrections is maintained by the computer and printed on the edit listing.

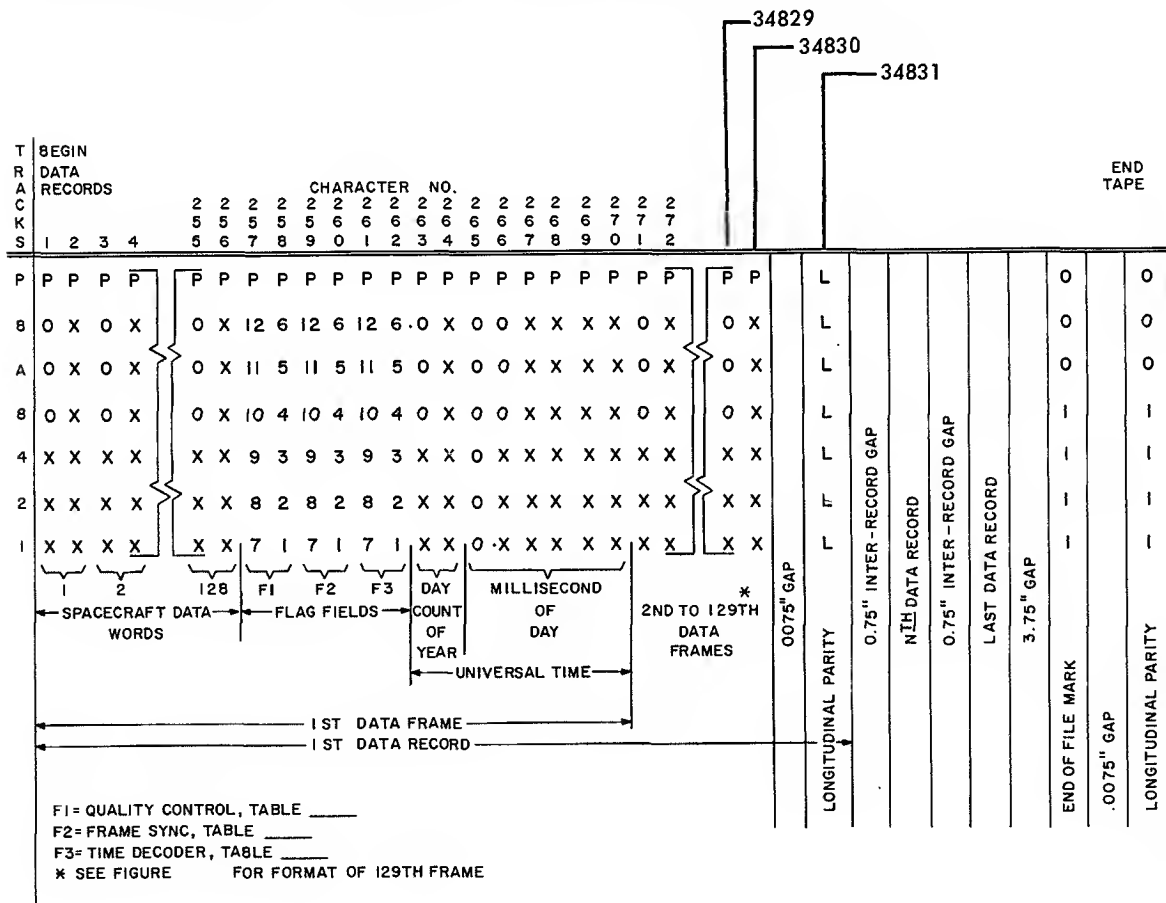


Figure 40—Format of Edit Tape Data Record

Every frame sync word is checked for bit errors. If three or more bit errors are found in the sync pattern, the frame is flagged in the status flag field as having data words of questionable validity. The total sum of sync bit errors for each frame is also reported in the frame status field. The sync bit error sums are further accumulated so that for each file of data on the edit tape, the percentage of frames having 0, 1, 2, and 3 or more bit errors respectively, will be calculated and listed.

Further checks are made by the computer on the accuracy and validity of the data. The parity, bit rate, data type (real time or playback), and spacecraft operational mode (normal, accelerated, subcom, or flexible format mode) of the data are checked and listed. The subcommutator count is checked for proper sequencing and data words are checked to assure that characters containing 9-bit telemetry words have 3 leading zeros. The computer will also insert frames of fill data (Figure 28) in an edit record to maintain integrity of the format and time-consistency. When fill data has been inserted, the status field of the appropriate frame will be so flagged. Time fields and status fields (Figures 42, 43, 44) will remain associated with a frame whether it is useful data or fill data.\* The milliseconds of day for each frame is checked to assure that the update of time is commensurate with the kilobit rate of the data frame.

The following is the format for a fill data word and the difference between fill data and normal data:

<u>Normal Data Word *</u>		<u>Fill Data Word *</u>	
0	X	1	0
0	X	0	0
0	X	0	0
X	X	0	0
X	X	0	0
X	X	0	0

\* 2 characters/word

Figure 41—Format of Fill Data

---

\*This is true of data which is time corrected by the edit program. However data processed as "quick look" or that which cannot be processed by the time correction portion of the edit program will have "fill" data in the time and status positions of those frames containing "fill" data.

Bit **	State	Representation for F1, Quality Control Status *
1-6		Total bit errors in the 27 bit frame sync word.
7	1	This frame is fill data
8	1	This frame is the beginning of a subcomm sequence
9 10	0 0	This frame contains 4 kilobit real time data
9 10	1 0	This frame contains 16 kilobits real time data
9 10	0 1	This frame contains 64 kilobits real time data
9 10	1 1	This frame contains command storage play-back data
11	1	This frame contains suspect data. This flag will appear when the bit errors in the frame sync word are $\geq 3$ .
12	1	This frame contains corrected time

\*Computer determined

\*\*Bit 12 is most significant bit , bit one is least significant bit

Figure 42—Quality Status Fields



Bit	State	Representation for F2, Time Status *
1	1	BCD decoded time agrees with the accumulating register
2	1	BCD decoded time disagrees with the accumulating register
1 + 10	1	BCD decoded time agrees with both the accumulating register and Serial Decimol decoded time. The experimenter can have good confidence in time when these flags appear
1 + 9	1	BCD decoded time agrees with the accumulating register but disagrees with SD decoded time
2 + 3	1	BCD decoded time disagrees with the accumulating register but agrees with SD decoded time. The experimenter should not have confidence in this time
2 + 4	1	BCD decoded time disagrees with both the accumulating register and SD decoded time. The experimenter should not have confidence in this time
5	1	SD decoded time agrees with accumulating register
6	1	SD decoded time disagrees with accumulating register
5 + 7	1	SD decoded time agrees with accumulating register but not with BCD decoded time
5 + 8	1	SD decoded time agrees with both the accumulating register and BCD decoded time. Again, the experimenter can have good confidence in time when these flags appear
6 + 7	1	SD decoded time disagrees with both the accumulating register and BCD decoded time. The experimenter should not have confidence in this time
6 + 8	1	SD decoded time disagrees with the accumulating register but agrees with BCD decoded time
11		BCD to Binary Converter circuit is in error. The experimenter should not have confidence in this time
12	0 or 1	Not used at present

\* Time status flags are a hardware function rather than computer determined. Experimenters should ignore this flag; it does not pertain to their data.

Figure 43—Quality Status Fields

Bit **	State	Representation for F3, Data Status*
1-7		Subcomm count; 0 - 127
8	1	Lock mode; in frame sync
8	0	Flywheel mode; still in lock but bit errors in frame sync exceed tolerance
9	1	In subcomm sync
9	0	Not in subcomm sync
10-12		Number of bit errors in frame sync word

\*Data status flags are a hardware function rather than computer determined.

\*\*Bit 12 is M.S., bit one is L.S.

Figure 44—Quality Status Fields

1 ORDER POLY FIT FOR 26 POINTS.

BATCH NUMBER 1

TM = .2618732869099999+11 CM = .2357172649999999+08

.125748293567448+01 = B0 .108419966000000-15 = B1

	OCTAL S/C CLOCK	DATA INPUT		CALCULATED		DIFFERENCE	
		DAY	MILLI-SEC	DAY	MILLI-SEC	DAY	MILLI-SEC
1	0131720617	303	5185197	303	5185199	-0	-2
2	0131720630	303	5194198	303	5194199	-0	-1
3	0131720641	303	5203198	303	5203199	-0	-1
4	0131720652	303	5212198	303	5212199	-0	-1
5	0131720663	303	5221198	303	5221199	-0	-1
6	0131720674	303	5230198	303	5230199	-0	-1
7	0131720705	303	5239198	303	5239199	-0	-1
8	0131720716	303	5248198	303	5248199	-0	-1
15	0131721015	303	5311200	303	5311199	-0	1
16	0131721026	303	5320200	303	5320199	-0	1
17	0131721037	303	5329200	303	5329199	-0	1
18	0131721050	303	5338200	303	5338199	-0	1
19	0131721061	303	5347200	303	5347199	-0	1
20	0131721072	303	5356200	303	5356199	-0	1
24	0131734174	303	11054185	303	11054186	-0	-1

MEASURE = .75000000-00 SQUARE ROOT OF MEASURE = .86602540-00

Figure 45-Time Fit Listing

**EDITED LABEL**

SAT	YR	STA	AN	AN	BU	DAT	SAT	YR	STA	AN	AN	BU	DAT	K	DAY	SEC	F	FF	E	BINA	BI	OP	LI		
ID	RE	NO	FI	TA	FI	TA	DIG	ID	RE	NO	FI	TA	FI	TA	DIG	R	YR	DAY	F	NO	G	TAPE	FI	ID	ID
65491	65	061	01	0111	01	0112	337	65491	65	061	01	0111	01	0111	337	3	272	80748	0	00	2	0015	07	29	02

START TIME	FIRST CLOCK	FRAME NUMBER
80748345	007007660174	88

STOP TIME	82562625	LAST CLOCK 0770770777	FRAME NUMBER
			127

END OF FILE

**\*BELOW SUMMARY IS FOR BIT STREAM UNADJUSTED FOR SHIFTS**

PER CENT OF FRAMES WITH ZERO SYNC BIT ERRORS	PER CENT OF FRAMES WITH ONE SYNC BIT ERROR	PER CENT OF FRAMES WITH TWO SYNC BIT ERRORS	PER CENT OF FRAMES WITH THREE OR MORE SYNC ERRORS
.3659	.0000	.0000	.6341

\*BELOW SUMMARY IS FOR BIT STREAM ADJUSTED FOR SHIFTS

.0829 PER CENT OF FRAMES WITH ZERO SYNC BIT ERRORS  
 .0000 PER CENT OF FRAMES WITH ONE SYNC BIT ERROR  
 .0000 PER CENT OF FRAMES WITH TWO SYNC BIT ERRORS  
 .3171 PER CENT OF FRAMES WITH THREE OR MORE SYNC BIT ERRORS

```
*SHIFT CNT TABLE..SYMMETRICAL ABOUT 0 SHIFTS OF BIT STREAM. LEFT (RIGHT) COL IS MAX LEFT(RIGHT) SHIFT. MAX IS
```

98.233 PER CENT OF FRAMES WITH ZERO SYNC BIT ERRORS

0.0000 PER CENT OF FRAMES WITH ONE SYNC BIT ERROR

# 0.000 PER CENT OF FRAMES WITH TWO SYNC-BIT ERRORS

1.7766 PER CENT OF FRAMES WITH THREE OR MORE SYNC ERRORS	
TOTAL NUMBER OF FRAMES PROCESSED	1576

TOTALS OF ERROR CONDITIONS (FRAMES WITH LESS THAN THREE SYNC BIT ERRORS)									
DATA TYPE--	0	KILOBIT RATE--	0	SUBCOM COUNT--	0	DAY OF YEAR--	0	DAY OF YEAR--	0
MODE-MAIN FRAME--	1550	MODE-ACCELERATED--	0	MODE-FLEXIBLE FORMAT	0	NONEXISTENT MODES--	0	NONEXISTENT MODES--	0
INVALID TIME	0	DECODER STATUS CHANGE	0	SYNC COUNT--	0		0		0
LOSS OF FRAME SYNC	13	WRONG LENGTH RECORD--	0	PARITY ERROR--	0	CONTROL UNIT SEQ--	0	CONTROL UNIT SEQ--	0
QUCARD									
STANALEDITLFFDAYSTART STOPFRAME PER0 PER1 PER2 PER3 MODE TIME TYPESUBCMOPSY									
55061011001520027280748325623	1576	9822	0	177	0	0	0	029139	
QFCARD									
060BCPA0111	651029	0000	15	01	222548	225602	0111	4	
WACARD									
060BCPA 0111	651029	0000			222548	225602		1	

Figure 46 (Continued)-Edit and Quality Listing

THE LAST EDIT TAPE NUMBER USED WAS- 15									
OGOB QUALITY CONTROL AND EDIT SUMMARY									
27 DEC 65									
STAT- ION NUMBER	ANALOG BUFFER EDIT TAPE TAPE		DAY OF YEAR	UNCORRECTED		CORRECTED		STOP	
				ELAPSED TIME	START TIME	ELAPSED TIME	START TIME	TIME	TIME
061	0101	0101	0014	125 02 15 30	53159644	061290344	02 15 30	53159644	61290344
061	0111	0111	0015	272 04 07 04	45440345	060264625	04 07 04	45440345	60264625
061	0111	0111	0015	272 01 56 24	60429345	067413625	01 56 24	60429345	67413625
061	0111	0111	0015	272 02 08 51	67571345	075302409	02 08 51	67571345	75302409
061	0111	0111	0015	272 00 33 04	75465345	077449649	00 33 04	75465345	77449649
061	0111	0111	0015	272 00 19 44	77481345	078665625	00 19 44	77481345	78665625
061	0111	0111	0015	272 00 29 18	78829345	080587473	00 29 18	78829345	80587473
061	0111	0111	0015	272 00 30 14	80748345	082562625	00 30 14	80748345	82562625
OGOB END OF JOB									

Figure 46 (Continued)-Edit and Quality Listing

Time Correction Phase – There are many facets to the time correction phase of the Edit Program.

(1) Real Time data:

Using selected tapes, ground station time is corrected for transmission delay from the S/C and the delay from WWV to the station. The high resolution points of the updating S/C clock are then found and the corresponding times (GMT) of update are then associated with them. The GMT and high resolution points are then punched onto cards. These cards are fed into another program which performs one to nth degree polynomial fits on the time. The residuals of the fits are compared and the best are chosen. The coefficients of the fits are fed back (Figure 45) into the Edit Program and all times on all tapes over specified intervals are corrected based upon this criteria. Residuals between computed time and the corrected ground time are printed to obtain further confidence in the accuracy.

(2) Playback data:

The coefficients of the fit previously chosen using RT data over a selected interval of time are input to the edit program when processing playback data. Since ground station time associated with the playback data has no value, no residuals are produced nor other comparisons made. Time computed from the polynomial fit is applied after the high resolution points of the S/C clock are found. If for some reason (e.g. noise), no high resolution points can be determined the data will be processed by the Quick look time correction and reformat program previously discussed.

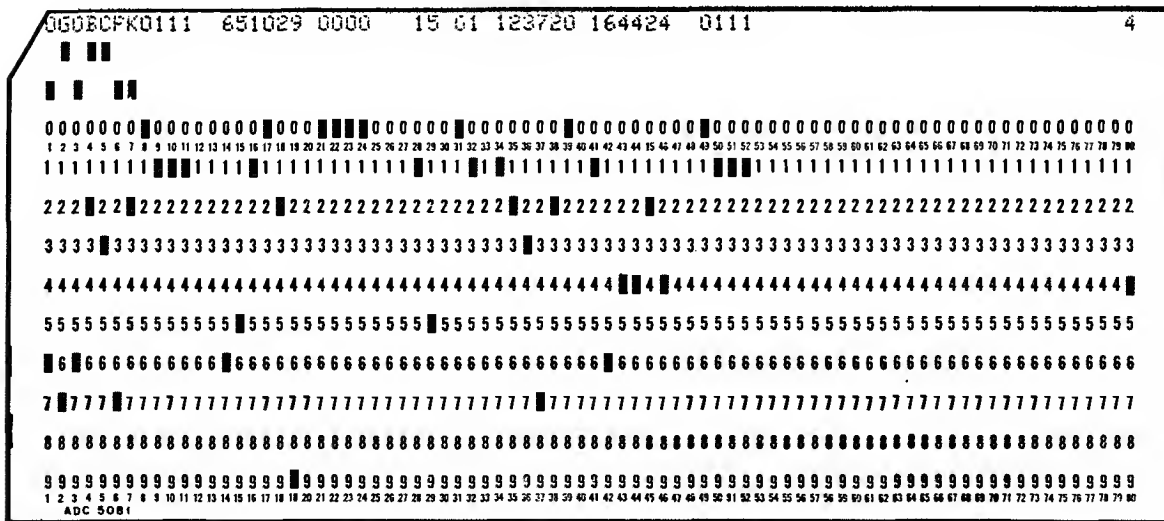
Note: When the time correction procedures contained in the Edit program are used the time of any particular frame is accurate to  $\pm 4$  ms. If the Quick look time correction procedures are used, time is accurate to within one second. The status field (Figure 42) contains a flag which, when lit, signifies that the time on the tape has been computed using the extensive time correction procedures of the edit program.

Quality Control

After each edit file (excluding Accelerated Subcommutator data) is completed a quality and housekeeping listing is printed (See Figure 46) which includes a formatted printing of the file label record as read independently from the input buffer file and the analog card; start and end times of the data file in terms of both Universal Time and spacecraft clock, the equipment group and flexible format in use, the rate of time between consecutive frames, the total number of

If a file is rejected, during the edit phase as it may be due to various conditions as invalid time, data type, mode, ID, record, and word length comparisons, generally the file rejected must be redigitized. If after redigitizing, the file is again rejected, it is set aside for the lifetime of the spacecraft before further remedial processing is done. When a file is rejected by the edit program, a brief message stating the reason will be given in the portion of the testing usually devoted to edit information.

In addition to punching time coefficient cards, the edit program punches for each file an edit card (Figure 47), a quality card (Figure 48), and a duplicate of the input analog card. The edit card becomes part of the records of the Production Control group in the further processing of the data. The quality card summarizes certain of the data quality indicators printed on the quality listing of each edited file, and is used to generate the quality listing which appears in Figure 49, and which summarizes this information for each edited file.



71



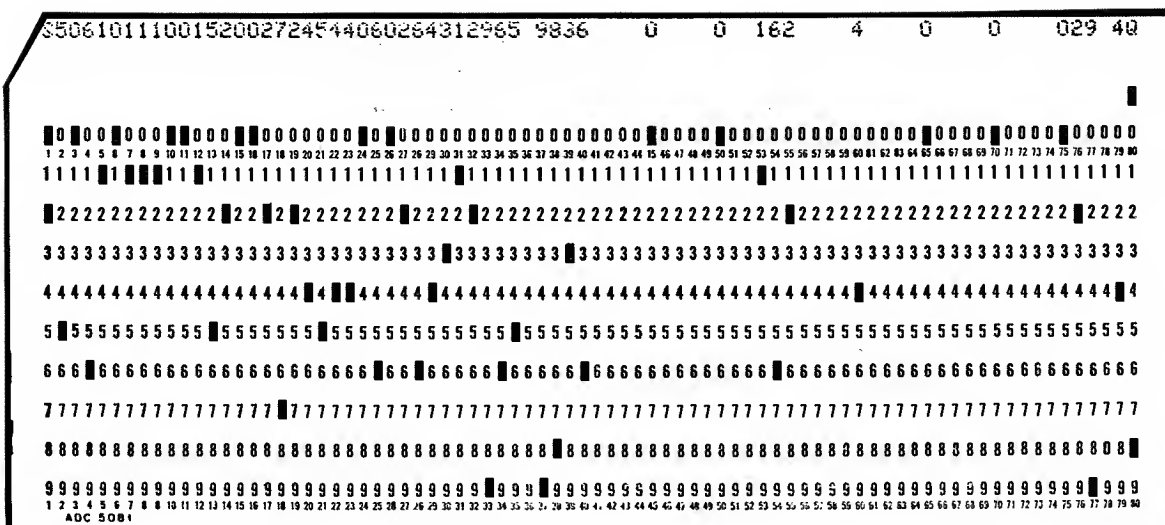


Figure 48—Quality Card

Edit tapes will be numbered by the program in consecutive order throughout the life of the satellite. The program also will instruct the computer operator to identify the completed edit tape with an external label. This label will show the OBO-B edit-tape number, the number of files included, the date of editing, and buffer tape from which it was made. Rejected files found capable of being reprocessed will be inserted in their proper position in the chronological sequence before decommutation if timely remedial reprocessing is anticipated. Otherwise, reprocessing will be allowed to proceed, but culminating in subsequent, separate decommutation of the data. Limiting the number of files per tape assures that all files will be completed on the original tape.

During processing of an edit file if a change in bit rate in spacecraft Equipment Group or in data format is observed, checked and verified by the computer, the current output file being written will be terminated and a new output file corresponding to the new configuration will be initiated. The data on the input buffer tape to the Edit and Quality Control program therefore, while containing one file representing one ground station pass, may ultimately be divided into two or more files emanating from the edit run.

### Terminal Digital Computer Processing

Decommutation Phase — The decommutation process produces experimenter tapes from the edit tapes. The basic output is one data record for each experimenter from each 128-frame edit record. The experimenter may request any

OGO-B  
QUALITY CARD LISTING

• LEGEND •

STA	STATION IDENTIFICATION NUMBER
TAPE NO	ANALOG TAPE NUMBER
EDIT NO	EDIT NUMBER
L	LINE IDENTIFICATION NUMBER
DAY	DATE RECORDED
START TIME	UNCORRECTED DIGITAL START TIME
STOP TIME	UNCORRECTED DIGITAL STOP TIME
KR	KILO BIT RATE
TOTAL FRAME	TOTAL FRAMES PROCESSED
0 ERROR	PERCENTAGE OF FRAMES WITH ZERO SYNC BIT ERRORS
1 ERROR	PERCENTAGE OF FRAMES WITH ONE SYNC BIT ERRORS
2 ERROR	PERCENTAGE OF FRAMES WITH TWO SYNC BIT ERRORS
3+ERROR	PERCENTAGE OF FRAMES WITH THREE OR MORE SYNC BIT ERRORS
MODE ERROR	NUMBER OF MODE CHANGES
IVAL TIME	NUMBER OF INVALID TIME COMPARISONS
TYPE ERROR	NUMBER OF INVALID DATA TYPE CHANGES
SUBCM COUNT ERROR	NUMBER OF INVALID COMPARISONS OF BUFFER SUBCM COUNT
OP IO	LINE OPERATOR IDENTIFICATION NUMBER
LOS FRA SYN	NUMBER OF TIMES FRAME SYNC WAS LOST
Q	QUALITY CARD IDENTIFICATION

STA	TAPE	EDIT	L	DAY	START	STOP	K	TOTAL	0	1	2	3+	MODE	IVAL	TYPE	SUBCM	UP	LOS
NO	NO	NO			TIME	TIME	R	FRAME	ERROR	ERROR	ERROR	ERROR	ERROR	TIME	ERROR	COUNT	IO	FRA
																ERROR		SYN
16	1	1	2	249	6826	7295	1	2619	7369	22	15	2592	9	0	3	5	2	13
20	1	2	2	249	11664	18162	1	41288	7066	126	42	2764	211	180	81	357	2	99
20	2	3	2	249	18211	17037	2	41658	8601	32	3	1362	110	1	31	205	2	99
20	3	4	2	249	18988	19201	2	11869	9627	16	1	353	12	1	0	5	2	19
20	6	5	2	249	21308	23284	1	13467	9193	30	0	775	20	45	2	14	2	17
20	10	6	2	249	23527	24629	1	7653	9073	168	20	736	30	4	7	26	2	9
20	11	7	2	249	24975	25273	0	264	9696	0	0	303	0	6	0	0	2	6
20	13	8	2	250	7022	7750	0	638	9874	0	0	125	0	6	0	0	2	2
20	13	9	2	250	7763	9410	1	10633	8918	70	2	1008	5452	19	1	21	2	13
20	14	10	2	250	16910	18385	1	10245	8254	62	0	1682	27	11	6	60	2	39
5	8	11	2	251	67123	67975	2	47212	9074	4	0	921	92	1	12	127	2	99
20	16	12	2	251	68044	68479	2	11888	9683	0	0	316	8	0	1	3	2	7
20	16	13	2	251	68492	70335	1	12226	9460	0	0	538	4	12	0	6	2	4
5	11	14	2	251	68481	69027	1	3791	9978	0	0	21	0	0	0	0	7	1
5	12	15	2	251	69020	70009	1	5786	8956	0	0	1043	8	2	3	6	7	11
5	13	16	2	251	69967	70917	1	5040	9517	0	0	482	1	3	0	0	7	2
20	18	17	2	251	70616	71412	1	4954	8716	20	4	1259	4	10	0	0	7	16
5	14	18	2	251	70904	71412	1	3204	5911	18	0	4069	3	27	0	6	7	12
20	19	19	2	252	77920	79006	1	7548	7954	549	133	1361	103	15	14	56	7	5
20	19	20	2	252	81012	82506	1	8760	7394	646	127	1831	141	19	30	159	7	21
5	17	22	2	254	74543	74852	1	2142	7591	480	37	1890	16	6	1	5	7	5
20	21	23	2	254	74594	76795	1	15287	9921	3	0	74	3	12	0	1	7	5
5	19	25	2	254	75561	76558	1	6925	8059	950	102	888	102	0	50	127	7	6
5	20	26	2	254	76425	77349	1	6421	7056	836	90	2016	136	0	63	190	7	10
20	22	27	2	254	76675	78267	1	11061	9920	34	0	44	11	0	0	1	7	3
5	23	28	2	254	77353	78267	1	6350	8214	1056	122	606	107	0	25	85	2	2
20	23	29	2	254	86138	852	1	7740	9989	0	0	10	0	2	0	0	2	1
20	24	31	2	255	902	2423	1	9521	9857	1	0	141	1	14	0	0	2	3
5	27	32	2	255	1789	2201	1	2860	6430	1772	290	1506	120	5	75	130	2	5
5	28	33	2	255	4732	5263	1	3686	6204	2034	393	1367	152	5	67	207	2	6
5	28	34	2	255	5210	6004	1	5385	5983	2046	367	1600	203	0	85	312	2	7
20	25	35	2	255	7718	8571	1	5931	9659	0	0	340	0	2	0	1	2	0
20	25	36	2	255	8593	8785	1	1336	9940	0	0	59	0	4	0	0	2	1
20	26	37	2	255	8758	9680	1	5888	9957	10	0	32	4	3	0	0	2	0
20	26	38	2	255	9699	10110	1	2128	9558	4	0	437	5	4	0	0	2	1
5	29	39	2	255	7742	8572	1	5760	6432	1765	319	1482	5219	0	57	228	2	0
5	29	40	2	255	8593	9680	1	6648	5649	2003	497	1848	293	3	56	380	2	7
5	29	41	2	255	9701	10110	1	2248	6098	1734	369	1797	91	3	15	102	2	10
20	27	42	2	257	12012	12801	2	43736	9027	263	47	661	202	1	98	283	2	52
20	29	43	2	257	12834	18289	1	37882	9782	17	4	195	32	3	1	16	7	14
20	34	44	2	257	19141	23162	1	27157	2963	342	135	6559	296	186	112	561	7	99
20	45	45	2	258	2621	9369	1	46736	9697	38	0	263	38	0	3	16	7	18
20	48	46	2	258	23238	30004	1	42382	9331	136	9	522	119	29	4	49	7	25
20	50	47	2	259	66739	67567	2	45992	9804	16	3	175	35	5	2	13	7	16
20	52	48	2	259	67827	69302	1	10245	8803	0	0	1196	20	1	2	5	7	18
20	54	50	2	259	69319	69980	2	36845	9300	84	12	603	85	0	10	103	7	42
5	37	51	2	259	69499	70095	2	33355	8974	142	40	842	163	0	35	234	7	98
20	54	52	2	259	69860	70284	2	18670	8802	112	19	1065	81	1	11	92	7	38
5	37	53	2	259	70080	70473	2	21831	7107	300	87	2504	287	9	74	476	7	99
5	39	54	2	259	70393	71240	2	47072	7155	663	113	2067	579	0	259	1232	7	99
5	41	55	2	259	71671	71846	2	9608	3242	2103	879	3774	238	0	439	1074	7	12
5	42	57	2	259	72412	72501	2	4729	2188	1901	960	4950	122	0	265	454	7	27
5	43	59	2	259	73896	74300	1	2808	9971	0	0	28	0	2	0	0	7	1
5	44	60	2	259	73882	76082	1	15280	8103	175	8	1712	413	2	178	272	7	6

Figure 49-Quality Listing

arrangement of experimenter data, the time field (universal time of the first word of the telemetry frame), status flag fields and necessary subcommutated data, from that 128-frame edit record.

Each experimenter tape will contain one or more files of data (Figure 50). The last file of the tape will be terminated with four End of File Marks. Within each data file on the experimenter's tape, all data records will contain data of like kilobit rate and will be from the same spacecraft data format. Playback data files will never appear on the same tape as real time data files. A file will never contain data from more than one ground station pass, although several different files may have been generated from a single station pass.

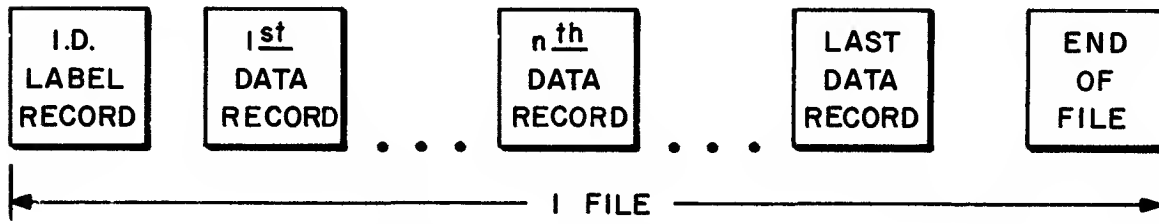


Figure 50—Format of a Decomm Tape File

Each file on the experimenter's tape will correspond to one of the input edit files. An experimenter receiving data from each of a number of edit files will therefore obtain a like number of files of decommutated data. The net effect of the correspondence with the input edit files is that a change in bit rate, spacecraft Equipment Group, or spacecraft data format will result in a new file appearing on an experimenter's decommutated data tape. Experimenter data will be on one-half inch wide magnetic tape written in binary mode (odd parity) with 556 characters to the inch. Each nine-bit telemetered word shall be represented by two six-bit characters. As shown in Figure 41, three zeros shall precede the first ( $2^8$ ), second ( $2^7$ ), and third ( $2^6$ ) highest order bits in the first character. The six low-order bits go in the second character.

The experimenters' data tapes of maximum length (in terms of data files), is given in Figure 51. Experiment Number 14 is listed as void since it is not on the OGO PCM System. Experiment Number 21 is the Housekeeping Tape, another product of decommutation. It contains spacecraft subcommutator information extracted from Channels 97, 98, and 99 during decommutation, and is used as input to two other terminal stage processing programs, the attitude-orbit program and the spacecraft subsystems program. The format of the Housekeeping Tape is given as Figure 52.

# MAXIMUM LENGTH OF EXPERIMENTER'S DATA RECORDS

Experiment	Max. # of data files per tape
49-01	5
49-02	4
49-03	9
49-04	—
49-05	5
49-06	6
49-07	5
49-08	6
49-09	2
49-10	5
49-11	4
49-12	6
49-13	6
49-14	—
49-15	6
49-16	64
49-17	6
49-18	6
49-19	9
49-20	9
49-21	5

Figure 51—Maximum Length of Experimenters data records

The experimenter will receive fixed-length records even when a data drop-out occurs. To maintain the standard record length and time consistency within the record, fill data (Figure 41) will be used to fill out the record. A 128-frame record containing fill data only will not be used. When data dropout exceeds the time span of 128 frames, a consequent time gap between records will then occur on the experimenters tape.

Since the major data unit of importance is a file and not a tape, each file will be labeled as shown in Figure 27. Each reel of tape mailed to the experimenter will be labeled with the following information: satellite name, experimenter's name, decommutation run number, experimenter's tape-sequence number from this run, and the number of files written on the experimenter's tape. The

### Format For Housekeeping Decomm Tape

<u>Character</u>	<u>Representation</u>
1-6 + 42N	Status Fields
7-12 + 42N	Milliseconds of Day
13-16 + 42N	Spares
17-18 + 42N	Day of Year
19-24 + 42N	Frame Sync (Channels 1,2,3,)
25-42 + 42N	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">Channel 98</div> <div style="font-size: 3em; margin-right: 10px;">}</div> <div>s/c Subcomm</div> </div> <div style="margin-left: 100px;">99</div> <div style="margin-left: 100px;">75 OPEP shaft position</div> <div style="margin-left: 100px;">33</div> <div style="margin-left: 100px;">34</div> <div style="margin-left: 100px;">35</div> <div style="margin-left: 100px;">65</div> <div style="margin-left: 100px;">66</div> <div style="margin-left: 100px;">67</div> <div style="margin-left: 100px;">}</div> <div style="margin-left: 100px;">s/c clock</div> <div style="margin-left: 100px;">s/c ID</div>

There are 5376 six bit characters/record or  
896 thirty-six bit words/record.

Figure 52-Housekeeping Tape Format

<u>Title Binary Record Format</u>		
<u>Word No.</u>	<u>Form</u>	<u>Remarks</u>
0	Fixed Pt.	Fortran data record size indicator = 000375010001 octal. This indicates a total data word count of 253 words.
1	Floating Pt.	Form of data identification = 76799361
2-3	Floating Pt.	Satellite identification
4	Floating Pt.	Date
5	Floating Pt.	Day Count of Year
6	Floating Pt.	Seconds of Day
		U.T. Start Time of Satellite Data
7	Floating Pt.	Date
8	Floating Pt.	Day Count of Year
9	Floating Pt.	Seconds of Day
		U.T. End Time of Satellite Data
10	Floating Pt.	$= \Delta t$ in seconds, if tape has equal intervals = 0, if tape has unequal intervals
11	Floating Pt.	No. of data items in data record = 12 (includes a special type of item as item no. 12)
12	Floating Pt.	No. of words per data item = 21
13	Floating Pt.	No. of words per data item that are a function of time (these words follow the time words consecutively) = 16
14	Floating Pt.	No. of words in data record = 256
15	Floating Pt.	Spare
16-26	Floating Pt.	Run identification data
27	Floating Pt.	Date
28	Floating Pt.	Day Count of Year
29	Floating Pt.	Apparent Sidereal Time in radians
		Coordinate System Reference Data Time and Position
30-40	Floating Pt.	Some of these are used for harmonics
41	Floating Pt.	Date
		Epoch
42	Floating Pt.	Day Count of Year
43	Floating Pt.	Seconds of Day
44	Floating Pt.	Semi-major axis, a (km)
45	Floating Pt.	Eccentricity, e (ratio)
46	Floating Pt.	Inclination, I (deg.)
47	Floating Pt.	Right ascension of ascending node, $\Omega$ (deg.)

Figure 53—Orbit 3A Tape Format

<u>Word No.</u>	<u>Fixed</u>	<u>Remarks</u>
48	Floating Pt.	Rate of change of R.A. of ascending node, (deg./day)
49	Floating Pt.	Argument of perigee, $\omega$ (deg.)
50	Floating Pt.	Rate of change of argument of perigee, (deg/day)
51	Floating Pt.	Period, P (min.)
52	Floating Pt.	Rate of change of period, $\dot{P}$ (min./day)
53-253	Floating Pt.	Some of these are used for elements, drags, etc.
254	Fixed Pt.	Check sum of words in word no. 1-253
255	Fixed Pt.	Same as word 0
<u>Data Binary Record Format</u>		
<u>Word No.</u>	<u>Fixed</u>	<u>Remarks</u>
0	Fixed Point	Fortran data record size indicator = 000375010001 octal. This indicates a total data word count of 253 words.
1	Floating Pt.	Type of data item indicator = 1 regular satellite data item = 2 ascending node crossing data item = 3 north point data item = 4 descending node data item = 5 south point data item = 6 sunlight entrance data item = 7 sunlight exit data item
2	Floating Pt.	Day of data
3	Floating Pt.	Day Count of Year
4	Floating Pt.	Second of Day
5	Floating Pt.	X
6	Floating Pt.	Y
7	Floating Pt.	Z
8	Floating Pt.	$\dot{X}$
9	Floating Pt.	$\dot{Y}$
10	Floating Pt.	$\dot{Z}$
11	Floating Pt.	Longitude (deg.)
12	Floating Pt.	Latitude (deg.)
13	Floating Pt.	Height above spherioid (km.)

Figure 53 (Continued)—Orbit 3A Tape Format

<u>Word No.</u>	<u>Form</u>	<u>Remarks</u>
14	Floating Pt. SX	
15	Floating Pt. SY	Solar Vector in A.U.
16	Floating Pt. SZ	
17	Floating Pt. L (earth radii)	McIlwain L Parameter
18	Floating Pt. B (Gauss	Magnetic Field Strength
19	Floating Pt. Right ascension (deg.)	Real Field Coord. in
20	Floating Pt. Declination (deg.)	an Inertial System
21	Floating Pt. Ascending node crossing no. (pass no.)	
22-231	Floating Pt. 10 other satellite data items	
232	Floating Pt. = 99 (may be considered type of data indicator)	
233	Floating Pt. Year of Data	
234	Floating Pt. = 999 if no ascending node item occurred. = % of orbit in sunlight if an ascending node item occurred in this record	
235-252	Spares in last item	
253	Spare in record	
254	Fixed Point Check sum of data words in word no. 1-253	
255	Fixed Point Same as word 0	

The last valid data item is followed by an item of 9's. If the last valid data item fills a record, a record follows which contains 9's in words 1-21. 9's are equal to 99999999 in floating point. Following the sentinel item record are 2 sentinel records containing 99999999 in word 1. Words 0, 254, and 255 follow the same format as that of regular data records. An EOF ends the tape.

NOTES:

Longitude is positive east of Greenwich, negative west.

Northern latitudes are positive, southern latitudes are negative.

Fortran record size indicator = 000375010001 octal in each record on this tape. This indicates a total word count per record of 253 words.

Date of data = day + 100 (months + year (100)). (Example: Feb. 10, 1962 at 2 hours is recorded as 620210 in date of data, 41 in day count of year and 7200 in seconds of day).

Reference day data of apparent sidereal time is obtained from "The American Ephemeris and Nautical Almanac" for the given year.

Figure 53 (Continued)—Orbit 3A Tape Format



computer operator will be instructed by the program to write this information on a label and to attach the label to the tape on the particular channel and unit assigned to the experimenter.

#### Attitude-Orbit Program

In order that the actual attitude of the spacecraft (as opposed to the ideal or theoretical attitude), be computed, spacecraft data from the Housekeeping Tape must be merged with orbit data (see Figure 53) provided by the Systems and Analysis Section of D. S. Division. Housekeeping data will not be available in the required chronological order until approximately four weeks after launch at which time computation of the actual attitude of the spacecraft will take place. The attitude-orbit program can be run without Housekeeping data to provide the ideal or theoretical attitude of the spacecraft. This will be done only upon request during the four weeks after launch, using predicted Orbit data obtained from the Systems and Analysis group. The format of the attitude-orbit tape is given on Figure 54. The attitude-orbit tape will be in binary mode, 556 characters per inch. Each tape can hold up to and including 3 full orbits.

#### Spacecraft Commands

Final processing of spacecraft commands on the digital computer is preceded by the transferral of commands to punched cards from the A/D conversion line, and by a comparison of the commands with OGO Control Center Command Reports by Quality Control. Punched cards of verified commands are then reformatted on the UNIVAC 1107, which also produces a command listing (Figure 55). The reformatted command cards are then written on magnetic tape for shipment to experimenters. At the end of each four month period after launch a cumulative summary in the same format of all commands processed through that date, will be shipped to experimenters on magnetic tape.

#### Analysis Programs for Goddard Experimenters

In addition to the data processing discussed throughout the remainder of this document, data from four GSFC experiments (Experiments 49-13, 49-15, 49-16, 49-20) will be analyzed using programs designed and written under the supervision of Data Processing Branch personnel. These programs will provide the experimenters with a display of the data acquired by their respective experiments in such a manner that their study of the data and final conclusions may be accomplished readily.

## ATTITUDE-ORBIT TAPE FORMAT

All data is represented in floating point format:

left 9 bits	characteristic
right 27 bits	mantissa

There is one orbit per file. After the EOF following the last data record, there is a (250 word) record of floating point nines, i.e., 99999999.0, which is followed by an EOF. Orbit 1 starts at the first ascending node after launch. All attitude-orbit tapes have odd parity.

Attitude-Orbit Label Record				
Word	Symbol	Function or Name	Description, Notes	Units
1	ID	Identification		none
2		Start time of orbit	Greenwich Mean Time (GMT) is used. This is also called Universal Time.	year
3				month
4				day
5	tE1	Eclipse start	Start time of eclipse in GMT.	day
6				millisec of day
7	tE2	Eclipse end	End time of eclipse in GMT	day
8				millisec of day
9	tO1	Orbit start	Start time of orbit. That is, time of the ascending node. The ascending node is that point in the equatorial plane through which the satellite passes while going from south to north. See Figure (c).	day
10				millisec of day

Figure 54—Attitude-Orbit Tape Format and Definitions

Word	Symbol	Function or Name	Description, Notes	Units
11 12	tO2	Orbit end	End time in GMT of this orbit and start time of the next orbit. That is, time of the next ascending node. See Figure (c).	day millisec of day
13 14	tn	Noon turn	Time in GMT of predicted noon turn. The paddles are only able to rotate through 180°. When the paddles are looking straight up ( $\varphi_p = 270^\circ$ ) or straight down ( $\varphi_p = 90^\circ$ ) at the sun, the spacecraft turns 180° about the body Z axis, so the paddle may reverse its direction of rotation and still continue to follow the sun. See data record word 121.	day millisec of day
15 16	$\tau$	Epoch	The arbitrary reference time in GMT at which the orbital elements were computed.	day millisec of day
17	$\Delta t$	Sampling rate	The values in the data records are given at intervals of $t_a + \Delta t$ . The value of $\Delta t$ is expected to be 60,000 milliseconds (1 min).	milliseconds
18		Orbit number	Orbit zero is from launch to the first ascending node. Orbit one starts at the first ascending node	none

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
19	a	Semi-major axis	and ends at the second ascending node. The $n^{\text{th}}$ orbit starts at the $n^{\text{th}}$ ascending node. See Figure (c).  The semi-major axis of the orbital ellipse (1 Earth radius = 6371.2 km). See Figure (a).	earth radii
20	e	Eccentricity	The eccentricity of the orbital ellipse. See Figure (a).	none
21	i	Inclination	The angle of the orbital plane and the earth's equatorial plane. See Figure (b).	degrees
22	$\Omega$	Longitude of ascending node	The angle between the Geocentric Equatorial Inertial (GEI) X axis (Y) and the position vector of the ascending node. See Figure (d).	degrees
23	$\dot{\Omega}$		Rate of change of $\Omega$ .	degrees/day
24	$\omega$	Argument of perigee	Perigee is that orbital point which is nearest the earth. $\omega$ is the angle between the position vector of the ascending node and the position vector of perigee. See Figure (c).	degrees
25	$\dot{\omega}$		Rate of change of $\omega$ .	degrees/day

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
26	T	Period	The time required to make one orbit.	minutes
27	$\dot{T}$		Rate of change of T.	minutes/day
28-99			Spares	
100	r	Spin rate	If the spacecraft is spinning about an axis which is stabilized with respect to the craft, the spin rate, r, is given as a positive number.	degree/sec
101	$\dot{r}$		Rate of change of r	degrees/sec/day
102-104	A	GEI spin axis	A = (Ax, Ay, Az) and is the spin axis as a unit vector in GEI coordinates. A is defined so the spin rate, r, is positive with respect to the right-hand rule.	none
105-107	Ab	Body spin axis	Ab = (Abx, Aby, Abz) is the spin axis as a unit vector represented in body coordinates. This representation will not change when the spin axis is stabilized with respect to the spacecraft.	none
108-116	R1	First spin matrix	In each of R1, R2, and R3, the first three words contain the values in the top	none

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
117-125	R2	Second spin matrix	<p>row of the matrix, the second three words contain the values in the middle row of the matrix, and the last three words contain the bottom row of the matrix.</p> <p>Let:</p> $b(T_1) = \begin{bmatrix} bXx & bYx & bZx \\ bXy & bYy & bZy \\ bXz & bYz & bZz \end{bmatrix}$ <p>where bXx through bZz are defined in data record words 49-57, i.e., bx, by, and bz at <math>T_1</math> where <math>T_1</math> is defined in word 1 of the data record. Now let <math>\bar{b}(T)</math> be the interpolation of <math>b(T_1)</math> to time T with no correction for spin.</p> <p>Then:</p> $\begin{aligned} b(T) &= \bar{b}(T) R1 + \bar{b}(T) R2 \sin \sigma(T) \\ &\quad + b(T) R2 \cos \sigma(T) \\ &= \bar{b}(T)   R1 + R2 \sin \sigma(T) + R3 \\ &\quad \cos \sigma(T)   \end{aligned}$ <p>where <math>b(T)</math> defines the body coordinate axes in GEI coordinates, as in <math>b(T_1)</math>, and</p>	
126-134	R3	Third spin matrix		

Figure 54-Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
135- 250			<p><math>\sigma</math> (T) is the angle from the spin vector <math>A(T_1) = (A_x, A_y, A_z)</math> at time <math>T_1</math> to spin vector <math>A(T)</math> at time T. See Application 3 in Appendix B for more details.</p> <p>Spares</p>	
Attitude-Orbit Data Record				
1	T1	Time	Day count.	days
2			Milliseconds of day in Greenwich Mean Time (GMT). All data in this record corresponds to $T_1$ .	milliseconds
3	TL	Local Time	Local Apparent Solar Time of subsatellite point.	hours
4				minutes
5				tenths of minutes
6	$\alpha$	Right ascension	The angle from the first point of Aries ( $\Upsilon$ ) to the equatorial plane projection of the spacecraft position vector. See Figure (e).	degrees
7	$\delta$	Declination	The angle from the equatorial plane projection of the spacecraft position vector to the	degrees

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
8,9, 10	P	Position vector	spacecraft position vector. See Figure (e).  P = (Px, Py, Pz) is the position vector of the spacecraft in Geocentric Equatorial Inertial (GEI) coordinates. GEI coordinates are also known as Universal coordinates. See Figure (e).	kilometers
11,12, 13	V	Velocity vector	V = (Vx, Vy, Vz) is the direction and magnitude of the spacecraft velocity in GEI coordinates. See Figure (e).	kilometers/ sec
14,15, 16	S	Solar vector	S = (Sx, Sy, Sz) is the position vector of the sun in GEI coordinates.	kilometers
17	$\phi$	Latitude	Geodetic latitude of sub-satellite point on the spheroid. North is +, South is -. The International Spheroid is used:  a = semi-major axis = 6378.388 km f = flattening = 297. = a/a-b.	degrees
18	$\lambda$	Longitude	Geodetic longitude of sub-satellite point on the spheroid. East is +, West is -.	degrees

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)



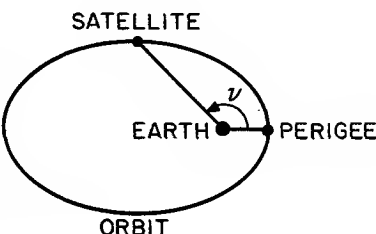
Word	Symbol	Function or Name	Description, Notes	Units
19	$h$	Height	Height of satellite above the spheroid. See Figure (e).	kilometers
20	$\nu$	True anomaly	Orbital central angle between perigee and satellite with earth as focus. See Figure (a).	degrees
				
21	$\Phi$	Sun earth satellite angle	The angle between the satellite position vector and the sun position vector.	degrees
22,23,24	$b_{XI}$	Ideal body roll axis	$b_{XI} = (b_{XIx}, b_{XIy}, b_{XIz})$ is the ideal body X axis as a unit vector in GEI coordinates.	none
25,26,27	$b_{YI}$	Ideal body pitch axis	$b_{YI} = (b_{YIx}, b_{YIy}, b_{YIz})$ is the ideal body Y axis as a unit vector in GEI coordinates.	none
28,29,30	$b_{ZI}$	Ideal body yaw axis	$b_{ZI} = (b_{ZIx}, b_{ZIy}, b_{ZIz})$ is the ideal body Z axis as a unit vector in GEI coordinates.	none

Figure 54--Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
31,32 33	PXI	Ideal paddle roll axis	$PXI = (PXIx, PXIy, PXIz)$ is the paddle X axis as a unit vector in GEI coordinates.	none
34,35, 36	PYI	Ideal paddle pitch axis	$PYI = (PYIx, PYIy, PYIz)$ is the paddle Y axis as a unit vector in GEI coordinates.	none
37,38, 39	PZI	Ideal paddle yaw axis	$PZI = (PZIx, PZIy, PZIz)$ is the paddle Z axis as a unit vector in GEI coordinates.	none
40,41 42	EXI	OPEP ideal roll axis	$EXI = (EXIx, EXIy, EXIz)$ is the OPEP X axis as a unit vector in GEI coordinates.	none
43,44, 45	EYI	OPEP ideal pitch axis	$EYI = (EYIx, EYIy, EYIz)$ is the OPEP Y axis as a unit vector in GEI coordinates.	none
46,47, 48	EZI	OPEP ideal yaw axis	$EZI = (EZIx, EZIy, EZIz)$ is the OPEP Z axis as a unit vector in GEI coordinates.	none
49,50, 51	bX	Actual body roll axis	$bX = (bXx, bXy, bXz)$ is the body X axis as a unit vector in GEI coordinates.	none
52,53, 54	bY	Actual body pitch axis	$bY = (bYx, bYy, bYz)$ is the body Y axis as a unit vector in GEI coordinates.	none

Figure 54--Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
55,56, 57	bZ	Actual body yaw axis	bZ = (bZx, bZy, bZz) is the body Z axis as a unit vector in GEI coordinates.	none
58,59, 60	PX	Actual paddle roll axis	PX = (PXx, PXy, PXz) is the paddle X axis as a unit vector in GEI coordinates.	none
61,62, 63	PY	Actual paddle pitch axis	PY = (PYx, PYy, PYz) is the paddle Y axis as a unit vector in GEI coordinates.	none
64,65, 66	PZ	Actual paddle yaw axis	PZ = (PZx, PZy, PZz) is the paddle Z axis as a unit vector in GEI coordinates.	none
67,68, 69	EX	Actual OPEP roll axis	EX = (EXx, EXy, EXz) is the OPEP X axis as a unit vector in GEI coordinates.	none
70,71, 72	EY	Actual OPEP pitch axis	EY = (EYx, EYy, EYz) is the OPEP Y axis as a unit vector in GEI coordinates.	none
73,74, 75	EZ	Actual OPEP yaw axis	EZ = (EZx, EZy, EZz) is the OPEP Z axis as a unit vector in GEI coordinates.	none
76	R	Magnetic range	$R = L \cos^2(\phi m)$ where L is the McIlwain parameter of the magnetic shell containing the spacecraft, and	earth radii

Figure 54--Attitude-Orbit Tape Format and Definitions (Continued)

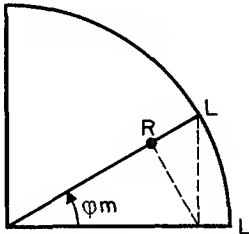
Word	Symbol	Function or Name	Description, Notes	Units
77	$\varphi_m$	Magnetic latitude	<p><math>\varphi_m</math> is the magnetic latitude of the spacecraft. Note that R is analogous to, but not equal to, <math> P </math>, the magnitude of the position vector.</p> <p>The latitude of the spacecraft in geomagnetic coordinates. At the magnetic equator <math>\varphi_m = 0</math>. See Figure (f).</p>  <p>RELATIONSHIP BETWEEN L AND R</p>	degrees
78	L	McIlwain parameter	<p>A magnetic shell parameter which is almost constant along lines of force. L is used to label each shell. Note that in the ideal case (dipole field), L is the magnitude of the position vector on the magnetic equator of the line of force. See Figure (f).</p>	earth radii
79	B	Field strength	The magnitude of magnetic field strength at	gamma

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
80	$B/B_0$	Ratio	the spacecraft. See Figure (c).  B is defined above. $B_0$ is the equatorial field strength of the shell. See Figure (f).	none
81	$\phi I$	Ingress latitude	The latitude of the point on the surface of the earth at which the magnetic line of force passing through the spacecraft enters the earth. See Figure (f).	degrees
82	$\lambda I$	Ingress longitude	The longitude of the point on the surface of the earth at which the magnetic line of force passing through the spacecraft enters the earth. See Figure (f).	degrees
83	$\phi E$	Egress latitude	The latitude of the point on the surface of the earth at which the magnetic line of force passing through the spacecraft leaves the earth. See Figure (f).	degrees
84	$\lambda E$	Egress longitude	The longitude of the point on the surface of the earth at which the magnetic line of force passing through the spacecraft leaves the earth. See Figure (f).	degrees

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
85,86, 87	$\hat{B}$	B vector	$\hat{B} = (B_x, B_y, B_z)$ is the direction of the magnetic line of force expressed as a unit vector in the GEI system.	none
88,89, 90	Bb	B Body	Bb = (Bbx, Bby, Bbz) is the unit direction vector, $\hat{B}$ , expressed in the body coordinate system.	none
91,92, 93	BP	B Paddle	BP = (BPx, BPy, BPz) is the unit direction vector, $\hat{B}$ , expressed in the paddle coordinate system.	none
94,95, 96	BE	B OPEP	BE = (BEx, BEy, BEz) is the unit direction vector, $\hat{B}$ , expressed in the OPEP coordinate system.	none
97,98, 99	$B\hat{B}G$	$B\hat{B}$ geodetic	<p><math>B\hat{B}G</math> is the product of the field strength, B, times the unit vector,</p> <p><math>\hat{B}G = (\hat{B}G_E, \hat{B}G_N, \hat{B}G_V),</math></p> <p>where <math>(\hat{B}G_E, \hat{B}G_N, \hat{B}G_V)</math> is the unit vector, <math>\hat{B}</math>, expressed in geodetic coordinates. Note that this is a left-handed system instead of a right-handed system.</p>	

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
100-108	TGSE	GSE transformation	<p>This is the transformation matrix which changes the GEI representation of a vector to GSE (Geocentric Solar Ecliptic) representation. The vector remains fixed. Words 100, 101, and 102 contain the values for the top row of the matrix, words 103, 104, and 105 contain the values for the middle row of the matrix, and words 106, 107, and 108 contain the values of the bottom row of the matrix. Any vector, <math>v</math>, in GEI is transformed by the relation</p> $v_{GSE} = (\text{matrix}) v_{GEI}$ $= TGSE v_{GEI}$	none
109-117	TGSM	GSM transformation	<p>This is the transformation matrix which changes the GEI representation of a vector to GSM (Geocentric Solar Magnetic) representation. The vector remains fixed. Words 109, 110, and 111 contain the top row of the matrix, words 112, 113, and 114 contain middle row of the matrix, and words 115, 116 and 117 contain the bottom row of the matrix.</p>	none

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
118-120	A	GEI spin axis	$A = (A_x, A_y, A_z)$ is the unit spin axis in GEI coordinates.	none
121	$\phi P$	Paddle angle	The paddle shaft angle is $\phi P = 90^\circ$ when the paddle is looking in the direction of the body +Z axis (toward earth), it is $\phi_p = 180^\circ$ when the paddle is looking in the -Y body axis direction (away from the OPEP), and $\phi P = 270^\circ$ when the paddle is looking in the body -Z direction (away from the earth). Movement of the paddle is restricted such that $90^\circ \leq \phi_p \leq 180^\circ$ .	
122	$\Psi E$	OPEP angle	The OPEP shaft angle is $\Psi E = 0$ when the OPEP is looking in the body +X direction (away from the spacecraft), and $\Psi E = 90^\circ$ when the OPEP is looking in the body +Y direction (away from the spacecraft), and $\Psi E = 270^\circ$ when the OPEP is looking in the body -Y direction (looking over the spacecraft). The OPEP can rotate through more than $360^\circ$ .	degrees

Figure 54-Attitude-Orbit Tape Format and Definitions (Continued)



Word	Symbol	Function or Name	Description, Notes	Units														
123	none	Attitude data flag	This flag is assigned the floating point value -1.0 if any housekeeping discrepancies are detected.	none														
124	none	NO DATA flag	<p>A value of <math>2^K</math> or any combination of <math>2^{K1} + 2^{K2} + \dots + 2^{K5}</math> in the NO DATA flag signifies that the data indicated by the flag was not available. The ideal value is used when the actual value is not available. The following table is used in words 124 and 125:</p> <table><tr><th>bit value</th><th>data</th></tr><tr><td><math>2^0</math></td><td>roll</td></tr><tr><td><math>2^1</math></td><td>pitch</td></tr><tr><td><math>2^2</math></td><td>yaw</td></tr><tr><td><math>2^3</math></td><td><math>\psi E</math> = OPEP shaft angle</td></tr><tr><td><math>2^4</math></td><td><math>\phi P</math> = Paddle shaft angle</td></tr><tr><td><math>2^5</math></td><td>Array error</td></tr></table> <p>(Note that word 124 is floating point.)</p>	bit value	data	$2^0$	roll	$2^1$	pitch	$2^2$	yaw	$2^3$	$\psi E$ = OPEP shaft angle	$2^4$	$\phi P$ = Paddle shaft angle	$2^5$	Array error	
bit value	data																	
$2^0$	roll																	
$2^1$	pitch																	
$2^2$	yaw																	
$2^3$	$\psi E$ = OPEP shaft angle																	
$2^4$	$\phi P$ = Paddle shaft angle																	
$2^5$	Array error																	
125	none	SUSPECT DATA flag	This word warns that the indicated data is of a suspected nature. The indica-	none														

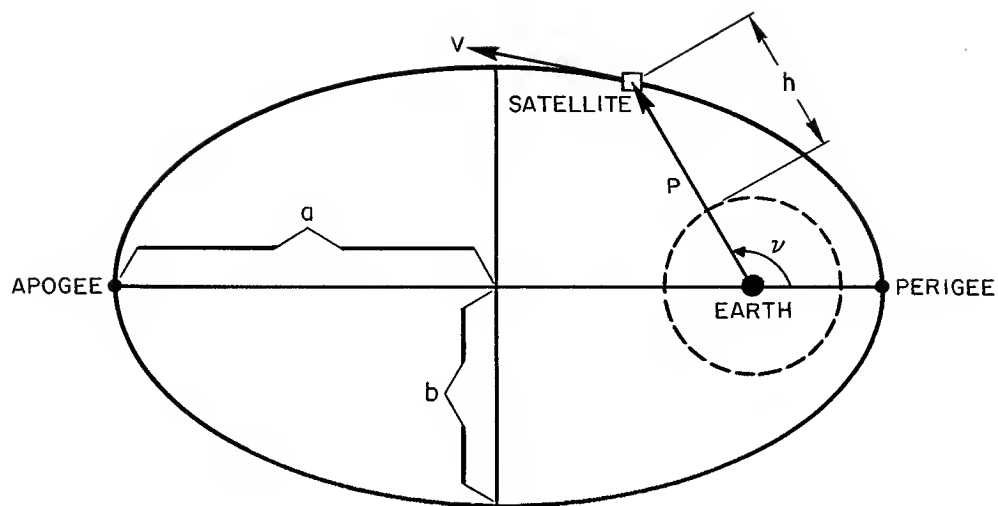
Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

Word	Symbol	Function or Name	Description, Notes	Units
126	T2	Time	tions are the same as for word 124.  T2 = T1 + $\Delta t$ and is defined the same as T1.	none
127-250			Defined the same as words 2-125 except that time T2 is used.	none

#### Abbreviations

EOF	End of File
GEI	Geocentric Equatorial Inertial (coordinates)
GMT	Greenwich Mean Time
GSE	Geocentric Solar Equatorial
GSM	Geocentric Solar Magnetic

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

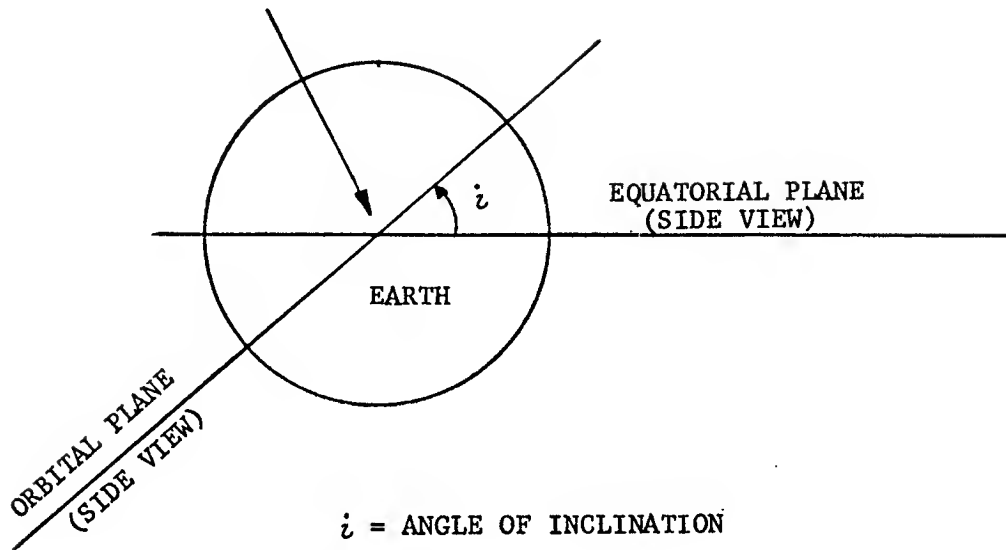


$e = \sqrt{1 - b^2/a^2}$  = ECCENTRICITY  
 a = SEMI-MAJOR AXIS  
 b = SEMI-MINOR AXIS  
 P = POSITION VECTOR  
 V = VELOCITY VECTOR  
 $\nu$  = TRUE ANOMALY  
 h = HEIGHT OF SATELLITE

(a)

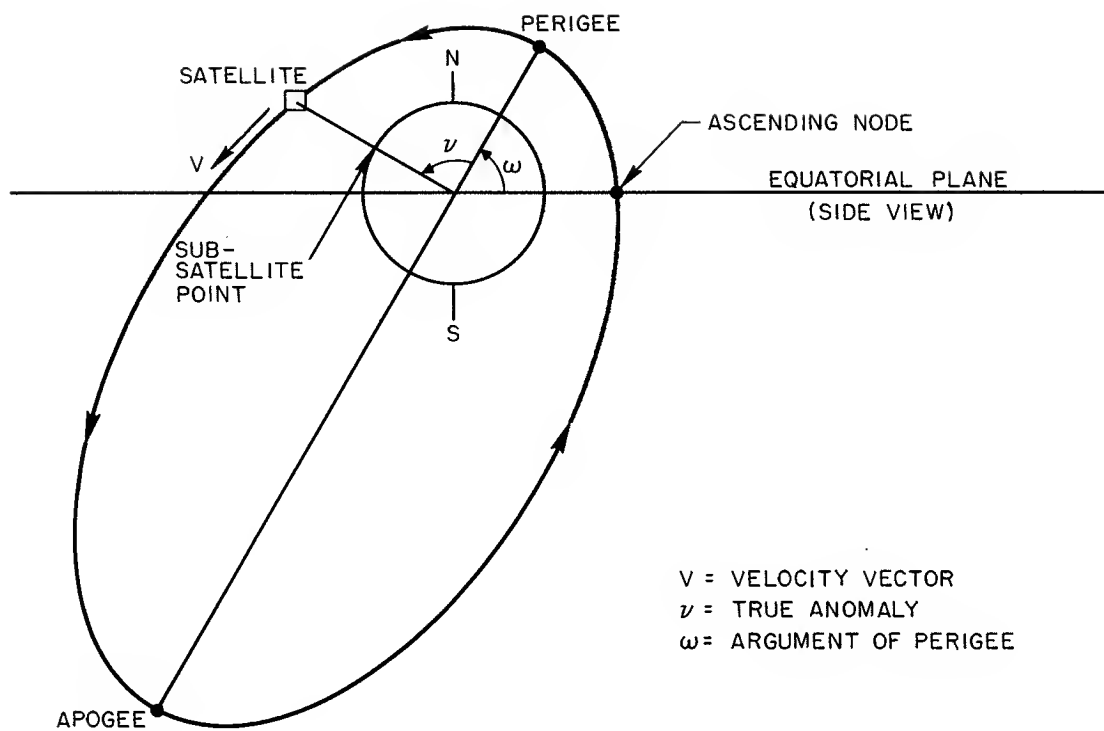
Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

ASCENDING AND DESCENDING NODES



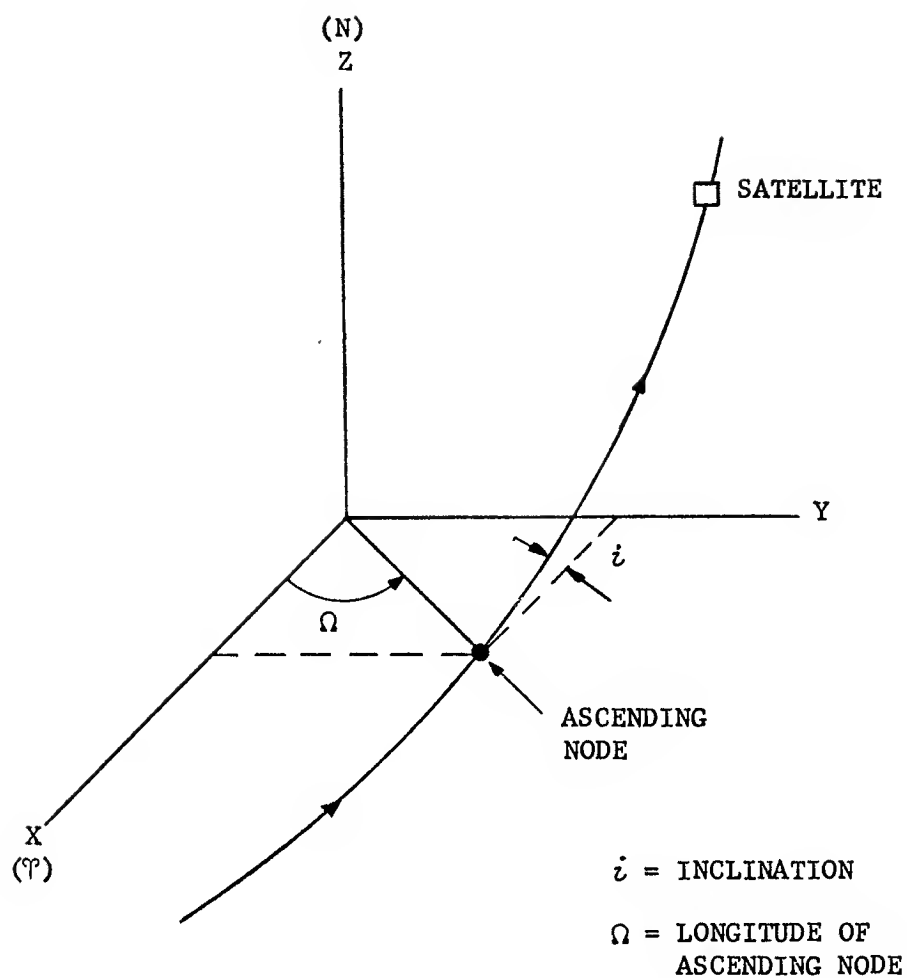
(b)

Figure 54-Attitude-Orbit Tape Format and Definitions (Continued)



(c)

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

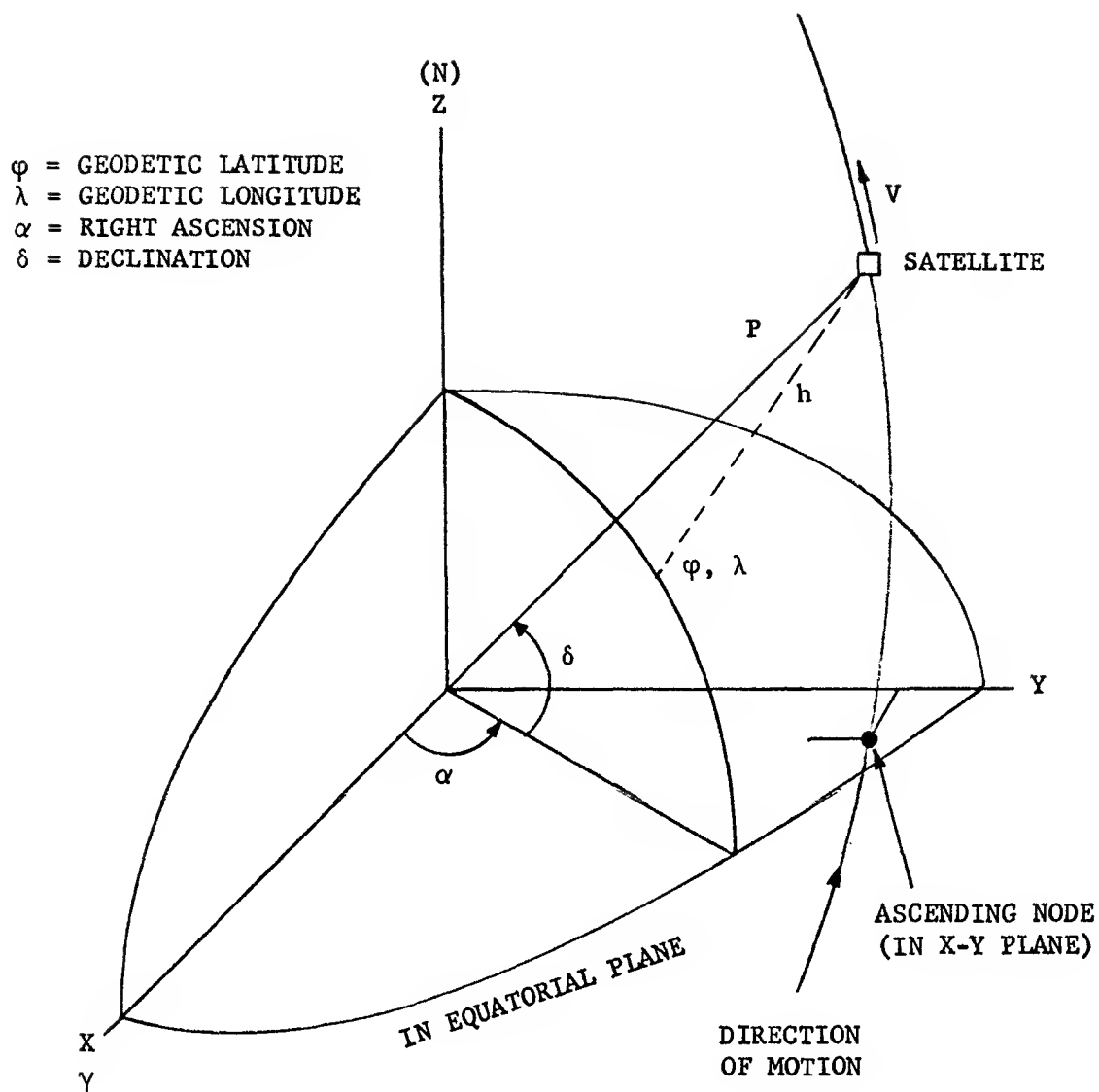


THE X-Y PLANE IS THE EQUATORIAL PLANE

NOTE THAT  $\Omega$  IS FIXED FOR ANY GIVEN ORBIT  
(GEI COORDINATES)

(d)

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)



NOTE THAT  $\alpha$  IS MEASURED FROM THE FIRST POINT ARIES ( $\Upsilon$ ) WHICH IS FIXED, AND  $\lambda$  IS MEASURED FROM GREENWICH WHICH SPINS WITH THE EARTH.

(e)

Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)

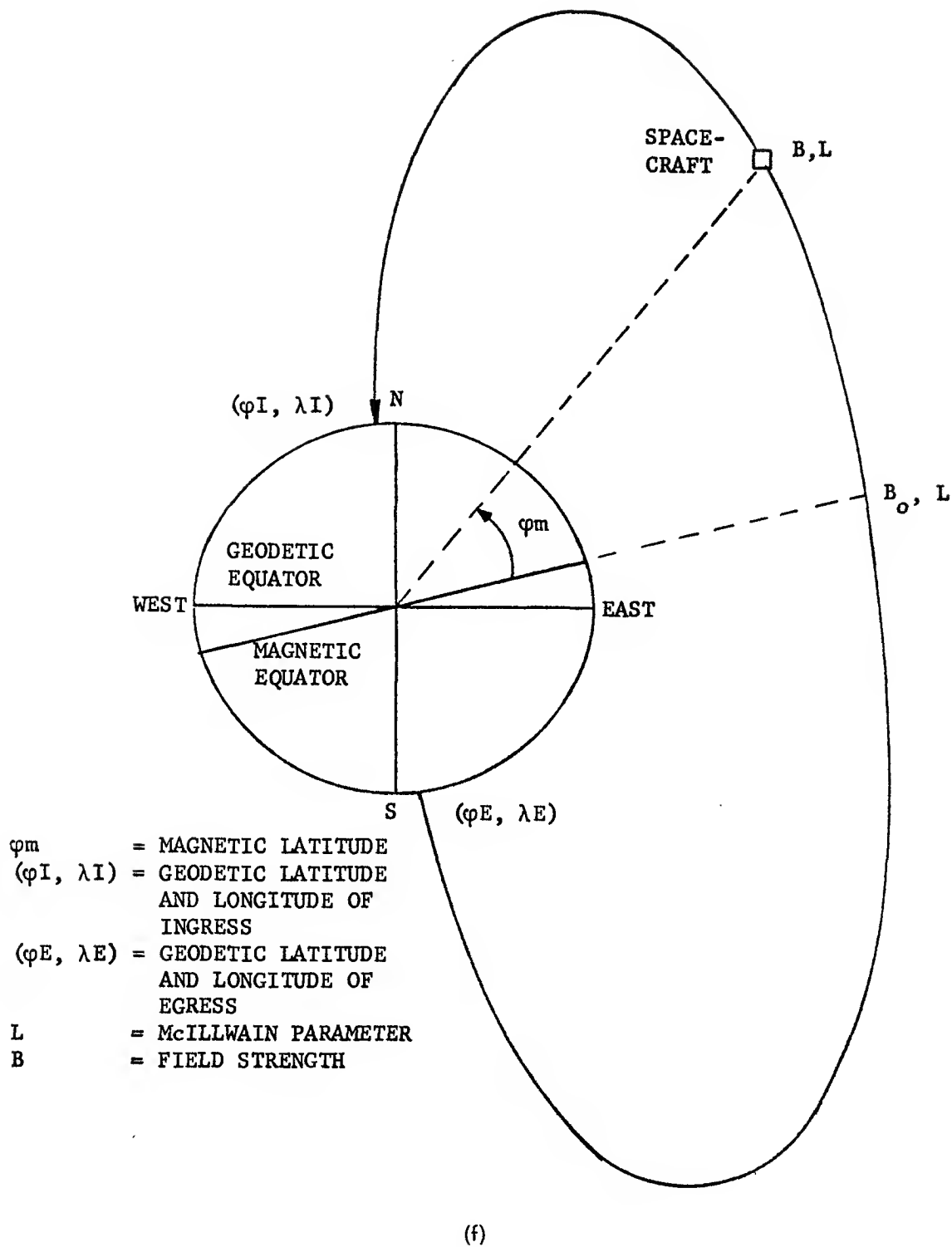


Figure 54—Attitude-Orbit Tape Format and Definitions (Continued)



S49 COMMAND CARDS

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EACH CARD CONTAINS THE PERTINENT INFORMATION FOR ONE COMMAND.  
 COLUMN ASSIGNMENTS ARE GIVEN BELOW.

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SSSSS	SATELLITE ID
YY	YEAR
GGG	GROUND STATION AT WHICH ANALOG DATA TAPE WAS RECORDED
TTTT	ANALOG DATA TAPE NUMBER CONTAINING DATA CORRESPONDING IN
DDD	DAY COMMAND WAS SENT
HH	HOUR COMMAND WAS SENT
MM	MINUTE COMMAND WAS SENT
	TIME TO THE TIME OF THE COMMAND
SS	SECOND COMMAND WAS SENT
MILLISEG	TIME IN MILLISECONDS OF THE DAY COMMAND WAS SENT
AAA	COMMAND ADDRESS IN OCTAL
CCC	COMMAND CODE IN OCTAL
XXXXXX	DESCRIPTION OF COMMAND FUNCTION

---

SSSSSYGGGTTTT	DDD	HH	MM	SS	MILLISEC	AAACCC	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
6454165	201421	50	22	10	30	79830000	44041 A EG 2 TO TAPE SELECT
6454165	201421	50	22	18	45	80325000	44253 X17 PC 40 ON
6454165	201421	50	22	18	57	80337000	44114 X17 IC 17
6454165	201421	50	22	19	7	80347000	44024 C XMTR SPEC PURP ON
6454165	201421	50	22	22	24	80544000	44253 X17 PC 40 ON
6454165	201421	50	22	22	33	80553000	44114 X17 IC 17
6454165	201421	50	22	23	39	80619000	44020 C XMTR WIDE A ON
6454165	201421	50	22	25	53	80753000	44253 X17 PC 40 ON
6454165	201421	50	22	26	3	80763000	44114 X17 IC 17
6454165	201423	50	22	30	21	81021000	44042 A TAPE 2 ON
6454165	201421	50	22	30	21	81021000	44042 A TAPE 2 ON
6454165	201421	50	22	30	42	81042000	44253 X17 PC 40 ON
6454165	201423	50	22	30	42	81042000	44024 C XMTR SPEC PURP ON
6454165	201423	50	22	30	42	81042000	44253 X17 PC 40 ON
6454165	201421	50	22	30	42	81042000	44024 C XMTR SPEC PURP ON
6454165	201423	50	22	30	44	81044000	44206 X5 PC 13 ON
6454165	201423	50	22	30	44	81044000	44207 X7 PC 15 ON
6454165	201421	50	22	30	44	81044000	44206 X5 PC 13 ON
6454165	201421	50	22	30	44	81044000	44207 X7 PC 15 ON
6454165	201423	50	22	30	45	81045000	44300 X9 PC 17 ON
6454165	201423	50	22	30	45	81045000	44303 X11 PC 23 ON
6454165	201421	50	22	30	45	81045000	44300 X9 PC 17 ON
6454165	201421	50	22	30	45	81045000	44303 X11 PC 23 ON
6454165	201423	50	22	30	46	81046000	44302 X11 PC21 ON
6454165	201423	50	22	30	47	81047000	44304 X12 PC 25 ON
6454165	201423	50	22	30	47	81047000	44344 X13 PC 26 ON
6454165	201421	50	22	30	47	81047000	44304 X12 PC 25 ON
6454165	201421	50	22	30	47	81047000	44344 X13 PC 26 ON
6454165	201423	50	22	30	48	81048000	44252 X5 PC 38 ON
6454165	201423	50	22	30	48	81048000	44345 X15 PC 28 ON
6454165	201421	50	22	30	48	81048000	44252 X5 PC 38 ON
6454165	201421	50	22	30	48	81048000	44345 X15 PC 28 ON
6454165	201423	50	22	30	49	81049000	44306 X15 PC 29 ON
6454165	201421	50	22	30	49	81049000	44306 X15 PC 29 ON
6454165	201423	50	22	30	50	81050000	44251 X15 PC 36 ON

\*The format of the Command Listing above applies to both OGO-B and OGO-A (S-49).  
 The OGO-A command list above will be replaced by OGO-B commands at final publication.

Figure 55-Command Listing

549 SATELLITE PROCESSING																PAGE	NO.
STA	TAPE	FILE	DATE	PASS	START	STOP	BUF	L	EDIT	FOIT	RECVD	DIGIT	EDIT	LECOM	SHIP	COMMENTS	
NO	NO	NO	RECORD	NO	TIME	TIME	NO		TAPE	FILE	DATE	DATE	DATE	DATE	DATE		
R05	0398	01	641017	0016	D	025646	045219	0247	C4	221	01	41020	41124	41207	50106	50106	.
R05	0403	01	641017	0016	D	044949	060104	0248	C4	222	01	41020	41124	41207	50106	50106	.
R05	0407	01	641017	0017	D	183312	184602	0249	C4	223	01	41021	41124	41207	50106	50106	.
R05	0411	01	641017	0017	D	191658	200748	0250	C4	224	01	41021	41124	41207	50106	50106	.
R05	0414	01	641017	0017	D	200731	202132	0251	C4	225	01	41021	41124	41207	50106	50106	.
R05	0415	01	641017	0017	D	202120	210710	0252	C4	226	01	41021	41124	41207	50106	50106	.
R05	0418	01	641017	0017	D	210731	212104	0253	C4	227	01	41021	41124	41207	50106	50106	.
R05	0420	01	641017	0017	D	212134	221710	0254	C4	228	01	41021	41124	41207	50106	50106	.
R05	0422	01	641017	0017	D	221731	223057	0255	C4	229	01	41021	41124	41207	50106	50106	.
R05	0424	01	641017	0017	D	223059	232712	0256	C4	305	01	41021	41124	41207	50106	50106	.
R05	0427	01	641017	0017	A	232700	234001	0257	C4	230	01	41021	41124	41207	50106	50106	.
R05	0428	01	641017	0017	A	235900	234200					41021	41124	41207	50106	50106	.
R05	0429	01	641017	0017	D	234132	003708	0258	C4	231	01	41021	41124	41207	50106	50106	.
R05	0431	01	641018	0017	D	003555	013208	0259	C4	232	01	41021	41124	41207	50106	50106	.
R05	0435	01	641018	0017	D	013112	022707	0260	C4	233	01	41021	41124	41207	50106	50106	.
R05	0438	01	641018	0017	D	022612	032206	0261	C4	234	01	41021	41124	41207	50106	50106	.
R05	0441	01	641018	0017	D	032111	041706	0262	C4	235	01	41021	41124	41207	50106	50106	.
R05	0444	01	641018	0017	D	041610	041638	0263	C4	236	01	41021	41124	41207	50106	50106	.
SKA	0189	01	641018	0017	A	050000	055700					41022	UT10				.
SKA	0192	01	641018	0017	A	060000	065700					41022	UT10				.
SKA	0188	01	641018	0017	A	065700	075300					41022	UT10				.
SKA	0193	01	641018	0017	A	075700	085200					41022	UT10				.
SKA	0203	01	641018	0017	A	085200	094700					41022	UT10				.
SKA	0201	01	641018	0017	A	094700	104300					41022	UT10				.
SKA	0205	01	641018	0017	A	104200	113200					41022	UT10				.
J08	0115	01	641018	0017	D	121850	135706	0264	C4	243	01	41026	41124	41207	50106	50106	.
J08	0116	01	641018	0017	D	135708	154742	0265	C4	244	01	41028	41124	41207	50106	50106	.
J08	0117	01	641018	0017	D	154743	173818	0266	C4	336	01	41028	41214	41215	50106	50106	.
J08	0118	01	641018	0017	D	173819	174313	0267	C4	337	01	41028	41214	41215	50106	50106	.
R05	0446	01	641018	0017	D	174304	183658	0268	C4	247	01	41021	41124	41207	50107	50107	.
R05	0447	01	641018	0017	D	183832	203134	0269	C4	248	01	41021	41124	41207	50107	50107	.
R05	0448	01	641018	0017	D	202908	222210	0270	C4	249	01	41021	41124	41207	50107	50107	.
R05	0449	01	641018	0017	D	221943	001245	0271	C4	250	01	41021	41124	41207	50107	50107	.
R05	0450	01	641019	0017	D	001019	020321	0272	C4	251	01	41021	41124	41207	50107	50107	.
R05	0451	01	641019	0017	D	020054	035624	0273	C4	252	01	41021	41124	41207	50107	50107	.
R05	0452	01	641019	0017	D	035357	054927	0274	C4	253	01	41021	41124	41207	50107	50107	.
R05	0453	01	641019	0017	A	054400	055100					41021	UT20				.
R05	0454	01	641019	0017	D	193201	210750	0275	C4	512	01	41026	41125	50105	50107	50108	.
R05	0455	01	641019	0017	D	210524	230054	0276	C4	255	01	41026	41124	41207	50107	50108	.
R05	0456	01	641019	0017	D	225559	005129	0277	C4	256	01	41026	41124	41207	50107	50108	.
R05	0457	01	641020	0017	D	006902	024205	0278	C4	257	01	41026	41124	41207	50107	50108	.
R05	0458	01	641020	0017	D	023938	043240	0279	C4	258	01	41026	41124	41207	50107	50108	.
R05	0459	01	641020	0017	D	043013	062811	0280	C4	259	01	41026	41124	41207	50107	50108	.
J08	0119	01	641020	0018	D	103125	164947	0281	C4	260	01	41029	41125	41207	50107	50108	.
J08	0120	01	641020	0018	D	104410	105620	0282	C4	261	01	41029	41125	41207	50107	50108	.
J08	0123	01	641020	0018	D	105811	110603	0283	C4	262	01	41029	41125	41207	50107	50108	.
J08	0124	01	641020	0018	D	113107	121217	0284	C4	263	01	41029	41125	41207	50107	50108	.
J08	0127	01	641020	0018	D	121267	122606	0285	C4	264	01	41029	41125	41207	50107	50108	.
J08	0128	01	641020	0018	D	122626	132202	0286	C4	265	01	41029	41125	41207	50107	50108	.
J08	0129	01	641020	0018	D	131917	141511	0287	C4	266	01	41029	41125	41207	50107	50108	.
J08	0130	01	641020	0018	D	141339	150915	0288	C4	267	01	41029	41125	41207	50107	50108	.
J08	0131	01	641020	0018	D	150820	160301	0289	C4	268	01	41029	41125	41207	50107	50108	.
R05	0460	01	641020	0018	D	155311	165305	0290	C4	336	01	41026	41124	41215	50107	50108	.
R05	0461	01	641020	0018	D	165210	170218	0291	C4	270	01	41026	41125	41207	50107	50108	.
R05	0462	01	641020	0018	D	170215	171602	0292	C4	271	01	41026	41125	41207	50107	50108	.

Figure 56—Chronological Listing



## Spacecraft Subsystem Processing

Processing of the S/C subsystem data falls into two categories: launch support and normal production phase. Operationally the processing of this data is shown in Figures 65 through 71. The launch support phase provides the OGO Project Office with plots and printouts of specified data on a near real time basis for the purpose of furnishing back-up support to the Control Center as well as complementing the processing and analysis done in the Control Center. The processing done in the normal production phase is used for detailed analysis of spacecraft history and/or failure analysis, etc.

The following pages represent the OGO Project Office data processing requirements for OGO-B. The listings are arranged by subsystem. The plots will be generated in the order of the listings and overlays placed at the end of each subsystem film strip. Three sets of film will be generated with one set delivered to Ken Kissen in the OGO Project Office, one set sent to TRW/STL and the third set sent to John Quann of the Telemetry Computation Branch.

The OGO-B requirements and program will be very similar to that for OGO-C. Such modifications for different calibrations & channel assignments which are necessary are relatively easy to add to update the program. In the list of requirements on the following pages the different subsystems are divided into separate display groups. This is how the data will normally be processed. However the case may arise where plots from different groups might be needed in one group. The program has this flexibility -- to build display groups using parameter cards as input.

Real Time, Main Commutator Mode -- 5 minutes of data per plot will be processed for a real time pass. This can represent 130 samples/parameter or 26 samples/minute at the 64 kb rate.

Real Time and Data Storage Accelerated Subcomm Mode -- 2 minute sampling will be used primarily during early orbital operations for determining that the  $0.5^\circ$  sec pitch rate is proper, that 2 complete earth acquisition cycles occur every 24 minutes, etc. Once these plots verify the proper functioning of the ACS the S/C can be commanded to start earth acquisition at the appropriate time.

Data Storage Main Commutator and Flexible Format Mode -- 1 orbit and 1 week plots will comprise the requirements for the normal production phase. All plots will be sufficiently labeled as to plot scale, parameter, time, etc. Examples of some plots are given in Figure 72. (Note S-50 data is used in the figures). Only playback data will be used as input in the generation of these plots.

Note: The time period covered by the data plots may be changed by simply inserting a card specifying the time interval desired.

The listing is as follows:

Set 1 Conditions: Data Mode ASC RT & DS, ACS Mode 1, 2A, 2B, or 2C

X (abscissa) = Time

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
1	24 min & 2 min	A1	1000 to 3000 psia	
	"	A3	10° to 30°	
	"	A21,A22	4 levels	Gas jets (events) should be plotted as number of firing. Use all samples.
2	"	A4	±8°	
3	"	A5	±8°	
4	"	A7,A38,A39	Events	
5	"	A10	±25°	
6	"	A11	±25°	
7	"	A17	±250 to 1400 RPM	Use A20 to affix signs where applicable to A17, A18,A19.
	"	A31	Indicate roll wh. on	
	"	A20 (wheel dir)		
8	"	A18	±250 to 1400 RPM	
	"	A31	Indicate pitch wh. on	
9	"	A19	±250 to 1400 RPM	
	"	A31	Indicate yaw wh. on	
	"	A20		
10	"	A24	0 to -0.6°/sec	

Set II Conditions: Data Mode ASC, ACS Mode 3

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
1	24 min & 2 min	A4	$\pm 4^\circ$	16° Total
		A5	$\pm 4^\circ$	
2	"	A10	$\pm 8^\circ$	32° Total
		A11	$\pm 8^\circ$	
3	"	A17, A20	$\pm 250$ to 1400 RPM	
		A31	Indicate roll wh. on	
4	"	A18, A20	$\pm 250$ to 1400 RPM	
		A31	Indicate pitch wh. on	
5	"	A19, A20	$\pm 250$ to 1400 RPM	
		A31	Indicate yaw wh. on	
6	"	A12, A13	90° to 270°	
		A16	Array drive on or off and direction	
7	"	A23	Events	

<u>Plot #</u>	<u>Time Scale (and true anomaly)</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
1	week	A1	0 to 3000 psi	
		A3	-10°C to +40°C	
2	5 min & orbit/true anomaly	A4	+4°	16° Total
		A5	+4°	
3	5 min & orbit/true anomaly	A10	+8°	32° Total
4	orbit/true anomaly	A17	±250 to 1400 RPM	Plot roll RW on-off
	"	A31	"	
5	"	A18	"	Plot pitch RW on-off
		A31		
6	"	A19	"	Plot yaw RW on-off
		A31		
7	"	A21, A22	Events	Note As+P.-P -P+Y, etc.
8	"	A12, A13	90° to 270°	
9	"	Δ Theoretical Array Angle and Measured Array Angle		
10	orbit/true anomaly	A14, A15	0° to 360°	
11	"	Δ Theoretical Array Angle and Measured Array Angle	±20°	
12	week	A9	-20° to +60°C	
13	week	A25	-20° to +60°C	Note sun on or sun off
14	orbit	A23		Note sun on or sun off

# C&DH Subsystem

Set IV Conditions: MC & FF RT & DS, 5 min/day orbit & week

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
1	5 min & week	C13, C14 F41A	-30 to -130 dbm	Use all calibration points and double plot redundant points. Note sig. pres. or not present.
2	"	C15, C16 F41B	"	"
3	week	F5	10 to 20 psia	(20 psia total)
		F13	10 to 20 psia	
4	"	F20	-5°C to +55°C	120°C total
		F22	-5°C to +55°C	Note when in sunlight or elipse
5	"	C5	3 to 6 watts	Do not overlap scales
		C6	0 to 0.1 watt	
6	"	C1	5°C to 35°C	Note WB A on or off
7	"	C7	3 to 6 watts	Do not overlap scales
		C8	0 to 0.1 watt	
8	"	C2	5°C to 35°C	Note WB B on or off
9	"	C9	0 to 1 watt	Do not overlap scale
		C3	0 to 40°C	



# Power Subsystem

Set V Conditions: MC & FF RT & DS, 5 min/day orbit & week

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
1	orbit	D10	20v to 40v	
2	5 min & orbit	(D4 + D5)		
		(D1 + D2)	3A to 11A	Load Current
3	"	(D10)X ((D4 + D5) - D1 + D2))	100w to 400w	Load Power
4	orbit	D1	±10A	
5	"	D2	±10A	
6	5 min & orbit	D8	20 to 40v	
		D55	2.5 to 5.1	Do not overlap
7	"	D9	20 to 40v	
		D56	2.5 to 5.1	"
8	orbit	D4	0 to 10A,	20A Total
		D5	0 to 10A	
9	"	D50	5° to 50°C	
10	"	D51	5° to 50°C	
11	"	D57	0 to 5v & 60° to +80°C	Overlay scales
12	orbit	D58, D14	0 to 5v & -60° to +80°C	Overlay scales
13	5 min & orbit	D6	20-40 volts	Overlay scales
		D7	0-20 volts	
		D17	0-4 amps	

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
14	week	Conv #2		Do not overlay scales
		D20	+16 ±1v	
		D21	+ 9 ±1v	
		D22	+ 5 ±0.5v	
		D23	- 6 ±0.5v	
15	week	Conv #3		"
		D24	+70 ±2v	
		D25	+23 ±1v	
16	week	Conv. #4		"
		D26	+70 ±2v	
		D27	+23 ±1v	
17	week	Conv. #5		
		D28	+16 ±1v	
		D29	+ 9 ±1v	
		D30	- 6 ±0.5v	
		D31	-16 ±1v	
18	week	Conv. #6		
		D32	+16 ±1v	
		D33	+ 9 ±1v	
		D34	- 6 ±0.5v	
		D35	-16 ±1v	
19	week	Conv. #7		"
		D36	+16 ±1v	
		D37	+ 9 ±1v	
		D38	- 6 ±0.5v	
20	week	Conv. #8		Do not overlay scales
		D39	+16 ±1v	
		D40	+ 9 ±1v	
		D41	- 6 ±0.5v	
21	week	Conv. #9		
		D42	+20 ±1v	
		D43	+10 ±1v	
		D44	-20 ±1v	
		D45	+28 ±1v	
		D46	115 ±5v	

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
22	week	Conv. #10		
		D52	+16 $\pm$ 1v	
		D53	+ 9 $\pm$ 1v	
		D54	- 6 $\pm$ 0.5v	
23	week	D15	400 cps	Sync signals Do not overlay scales
		D16	2461 cps 0°	
			2461 cps 90°	

# Thermal Subsystem

Set VI Conditions: MC & FF DS only

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
1	orbit & week	E1	-30°C to +80°C	
		E2	"	
		E3	"	
		E4	"	
2	"	D13	-50°C to +75°C	
		D14	"	
3	week	A33	20°C to 100°C	
		A34	"	
4	"	A25	-20°C to +80°C	
		A26	"	
5	"	A9	-20°C to 50°C	
		A30	20°C to 80°C	
		A32	0 to +60°C	
6	"	E28	-20°C to 80°C	
7	"	B15	-20°C to 60°C	
8	"	E13	-20°C to +50°C	
		E14	-20°C to +50°C	
		E14	"	
		E16	"	
		E17	"	
9	"	E19	-20°C to +40°C	
		E20	"	
10	"	SC1-50	95°C to 135°C	
		SC1-114	95°C to 135°C	
		SC1-51	25°C to 55°C	
		SC1-115	25°C to 55°C	

<u>Plot #</u>	<u>Time Scale</u>	<u>Parameter</u>	<u>Parameter Scale</u>	<u>Remarks</u>
11	week	SC1-96	-20°C to +60°C	
12	"	SC1-97	-20°C to +60°C	
13	"	SC1-110	-20°C to +60°C	
14	"	SC1-94	-20°C to +60°C	
		SC1-95	"	
15	"	SC1-62	"	
		SC1-117	"	
16	"	SC1-84	"	
		SC1-83	"	
17	"	SC1-118	-20°C to +60°C	
		SC1-119	"	
		SC1-48	"	
		SC1-54	"	
		All others	-5°C to +45°C	

## Accounting

Two end-action features are employed to render periodic production accounting to all EGO experimenters, the Project Scientist, and the OGO Project Office of what data has been processed, what has not, and what the state of data quality is. For each file of decommutated data, the pertinent analog and edit cards are processed to produce the monthly Chronological Listing which appears as Figure 42. For each file of decommutated data, the quality card generated for the file during edit and quality control is also processed on the computer to produce the monthly Quality Listing which appears as Figure 56. Both listings are dispatched monthly to the parties above.

### Punched Card Summary

A. Analog Card - punched from ground station log sheet by EAM personnel (Figure 38).

B. Time Coefficient Card - punched by the UNIVAC 1107 Time Fit Program to provide coefficients of the nth order polynomial time curve (Universal Time vs spacecraft clock) to Edit Program time-correction operations (Figure 45).

C. Edit Card - One card is produced by the computer for each file edited (Figure 47). These become part of the records of Production Control.

D. Quality Card - One card is produced by the computer for each file edited (Figure 48). These become part of the records of Production Control and contain quality information presented on the Edit listing of the file and on the monthly Quality Listing.

E. Decommutation Cards - These cards are produced by the computer after each file is processed (Figure 57). The information contained on them identifies the source, the bit rate, and spacecraft format of the file and where the file may be found on each of the experimenter's data tapes. The decommutation run numbers will also be included.

F. Intermediate Command Card - punched by Command decoder for use in the Command Card Reformat Program (Figure 58).

G. Reformatted Command Card - punched by the Command Card Reformat Program. The card images are written on magnetic tape and dispatched to all experimenters (Figure 59).

ID																	
18 characters												Time					
												12 char.					
												6 char.					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Command ID (BCD)			Time (BCD)			Commands (Octal)		
Character	Information		Character	Information		Character	Information	
1-5	Satellite ID		19-21	Day of Year		31-33	Command Address	
6-7	Year of recording		22-23	Hour		34-36	Command	
8-10	Station number		24-25	Minute				
11-14	Analog tape number		26-27	Second				
15-16	Analog file number		28-30	Millisecond				
17-18	Blank							

Figure 58-Intermediate Command Card Format

2			2
4	Satellite	IDENTIFICATION	4
6	Year of Recording		6
8	Station Number		8
10			10
12	Analog Tape Number		12
14			14
16	Unused		16
18	Day	TIME OF COMMAND	18
20	Blank		20
22	Hour		22
24	Blank		24
26	Minute		26
28	Blank		28
30	Secand		30
32	Unused		32
34		TIME OF COMMAND	34
36	Millisecand of Day		36
38			38
40	Blank		40
42	Command Address in Octal		42
44	Blank		44
46	Cammand in Octal		46
48	Unused		48
50	S/C or Exp CMD Flag		50
52			52
54	Comments		54
56			56
58			58
60			60
62			62
64			64
66			66
68			68
70			70
72			72
74			74
76			76
78			78
80			80

Figure 59—Reformatted Command Card



## Listing Summary

A. Edit and Quality Control Listing - printed by the Edit and Quality Control Program for each edited file (Figure 46). The listing provides Quality Control personnel with the data quality indicators, file label listings, time-updating characteristics, and the summarized data validity checks which they must employ in their decision to release the edited file for decommutation or reject it for re-processing.

B. Decommutation Listing - printed by the Decommutation Program for each data file (Figure 60). The Label Record contents for each file are listed, as well as the contents of the file's decommutation cards. The listing is used by Quality Control personnel to assure that decommutated files do not overlap in time.

C. Shipping List - printed by the computer using the decommutation card as input (Figure 61). The shipping list in two copies accompanies each shipment of decommutated tapes to the experimenter and identifies the data files, spacecraft data formats, operational mode (real time or playback), bit rates, and start-stop times of the data on the tapes. Also identified are the analog, buffer and edit tape numbers associated with each file of decommutated data. One copy of the shipping list must be signed as a receipt by the experimenter and returned to the GSFC Data Processing Branch.

D. Quality Listing - printed monthly on a cumulative basis by the computer using the Quality cards as input (Figure 49). The listing provides for each edited file a summary of the data quality and validity determined for the file in the Edit Program. Specific items, referenced on the listing appear in the Legend (Figure 37) which accompanies each listing. The Quality listing is dispatched monthly to all experimenters, to the Project Scientist, and to the OGO Project.

E. Chronological Listing - printed monthly on a cumulative basis by the computer using the analog cards and updated by the Edit Program, and the Edit card (Figure 56). A separate listing is made for real time data and for playback data. Both indicate the extent of production processing rendered on all incoming ground station tapes, and both are distributed to all experimenters, to the Project Scientist, and to the OGO Project.

F. Command Listing - printed monthly on a non-cumulative basis by the computer using punched command cards (Figure 55). The listing contains spacecraft commands verified and released by the Quality Control group. The listing is distributed to all experimenters and to the OGO Project Office.

OGO DECOM XGT FLOW (CONSOLE LOG MORE COMPLETE)										DATE	140266	PAGE	5
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 45440 0 00	0608CPK011101650929	0015 01 123720	002 01010101010101000101010101 5	2 0015 01 29 02	0100214								
0608CPK011101650929	0015 01 123720	002 010101010101010101010101 6											
0608CPK011101650929	0015 01 123720	002 010101010101010101010101 7											
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 60429 0 00	0608CPK011101650929	0015 02 164709	002 0102010201020100010201020102 5	1 0015 02 29 02	0100214								
0608CPK011101650929	0015 02 164709	002 0102010201020102010201020102 6											
0608CPK011101650929	0015 02 164709	002 0102010201020102010201020102 7											
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 67571 0 00	0608CPK011101650929	0015 03 184611	002 0103010301030100010301030103 5	2 0015 03 29 02	0100214								
0608CPK011101650929	0015 03 184611	002 0103010301030103010301030103 6											
0608CPK011101650929	0015 03 184611	002 0103010301030103010301030103 7											
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 75465 0 00	0608CPK011101650929	0015 04 205745	002 0104010401040100010401040104 5	1 0015 04 29 02	0100214								
0608CPK011101650929	0015 04 205745	002 0104010401040104010401040104 6											
0608CPK011101650929	0015 04 205745	002 0104010401040104010401040104 7											
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 77481 0 00	0608CPK011101650929	0015 05 213121	002 0105010501050100010501050105 5	2 0015 05 29 02	0100214								
0608CPK011101650929	0015 05 213121	002 0105010501050105010501050105 6											
0608CPK011101650929	0015 05 213121	002 0105010501050105010501050105 7											
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 78829 0 00	0608CPK011101650929	0015 06 215349	002 0201020102010100010602010106 5	1 0015 06 29 02	0100214								
0608CPK011101650929	0015 06 215349	002 01060201010601060106030201060106 6											
0608CPK011101650929	0015 06 215349	002 0201010602020106010601060106 7											
65491 65 061 01 0111 01 0112 337 65491 65 061 01 0111 01 0111 337 3 272 80748 0 00	0608CPK011101650929	0015 07 222548	0202020202020100020102020201 5	2 0015 07 29 02	0100214								
0608CPK011101650929	0015 07 222548	0201020201070107040102010107 6											
0608CPK011101650929	0015 07 222548	020201070203020102010101070201 7											
SP HDG OGO DECOM DIAGNOSTICS (IF ANY)													

Figure 60-Decomm Listing

STA	TAPE	FILE	RECORDED	EOIT	EOIT	START	STOP	DECOM	EXP 1	EXP 2	EXP 3	EXP 5	EXP 6	EXP 7	EXP 8	EXP 9	EXP 10
YR	MO	QY	TAPE	FILE	HR	MN	HR	MN	EXP 1	EXP 2	EXP 3	EXP 5	EXP 6	EXP 7	EXP 8	EXP 9	EXP 10
CPK	0111	01	65	09	29	0015	01	12	37	T	F	T	F	T	F	T	F
CPK	0111	01	65	09	29	0015	02	16	47	T	F	T	F	T	F	T	F
CPK	0111	01	65	09	29	0015	03	18	46	T	F	T	F	T	F	T	F
CPK	0111	01	65	09	29	0015	04	20	57	T	F	T	F	T	F	T	F
CPK	0111	01	65	09	29	0015	05	21	31	T	F	T	F	T	F	T	F
CPK	0111	01	65	09	29	0015	06	21	53	T	F	T	F	T	F	T	F
CPK	0111	01	65	09	29	0015	07	22	25	T	F	T	F	T	F	T	F
									22	56	002	02	02	02	02	02	02

TOTAL NO. OF FILES - 7

THIS COPY IS TO BE RETAINED FOR YOUR INFORMATION  
PLEASE SIGN AND RETURN THE ATTACHED RECEIPT FORM TO -  
DIGITAL DATA ACCOUNTING OFFICE  
DIGITAL DATA CONTROLLER  
NASA GODDARD SPACE FLIGHT CENTER  
CODE 564  
GREENBELT, MO. (20771)

EXP 1 - HOOKER - WCAL	EXP 6 - LUDWIG / MCDONALD / CLINE - GSFC
EXP 2 - WOLFE - AMES	EXP 7 - LENTZ - CHICAGO
EXP 3 - VASYLIUNAS - MIT	EXP 8 - BULGREEN - IOWA
EXP 4 - DAVIS - GSFC	EXP 9 - WINKLER / ARNOLDY - UMINN
EXP 10 - HOLZER -UCAL	

Figure 61A-Shipping Document



G. Playback Reformat and Time Correction Listing – printed during operation of the Playback Reformat and Time Correction program to provide operating personnel with verification of valid playback reformatting and Quick-Look time correction (Figure 62).

```

INFLI TAPE IDENTIFICATION
BUFFER TAPE NUMBER      0006
ANALOG TAPE NUMBER      0006
STATION NUMBER          020
S-50

OUTPUT TAPE START TIME
000135041602  OCTAL SPACE CRAFT CLOCK      30106836  CORRECTED GROUND TIME      12801014  UNCORRECTED GROUND TIME
24396674  DECIMAL SPACE CRAFT CLOCK

      94  CORRECTED DAY COUNT OF YEAR      105  UNCORRECTED DAY COUNT OF YEAR

OUTPUT TAPE STOP TIME
000135042174  OCTAL SPACE CRAFT CLOCK      30356836  CORRECTED GROUND TIME      12802847  UNCORRECTED GROUND TIME
24396924  DECIMAL SPACE CRAFT CLOCK

      94  CORRECTED DAY COUNT OF YEAR      105  UNCORRECTED DAY COUNT OF YEAR

TOTAL NUMBER OF RECORDS PROCESSED      110

```

Figure 62–Playback Reformat and Time Correction Listing

### Tape Disposition

One month after the experimenter tapes have been released by Production Control, the analog station tapes and the edit tapes will be transferred to Federal Archives and the buffer tapes will be stored at GSFC Data Processing Branch.

The experimenter tapes will be mailed to the following addresses:

## S-49 (OGO-B) DISTRIBUTION

02/04/66

EXP. NO.	EXPERIMENTER	DECOM TAPES	ATT/ORB TAPES	COMMAND CARDS	Q. CARD LISTINGS	CHRONO LISTINGS
1	MR. FLOYD B. HOOKER UNIVERSITY OF CALIFORNIA SPACE SCIENCES LABORATORY BERKELEY, CALIFORNIA 94720	X	X	X	X	X
2	DR. JOHN W. WOLFE SPACE SCIENCES DIVISION NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIF. 94035	X	X	X	X	X
3	MR. VYTENIS VASYLIUNAS ROOM 20-D-004 MASSACHUSETTS INSTITUTE OF TECHNOLOGY CAMBRIDGE, MASS. 02139	X	X	X	X	X
5	MR. LEO DAVIS CODE 611 BLDG. 6, ROOM W-8 G.S.F.C.	X	X	X	X	X
6	DR. GEORGE LUDWIG C/O MRS. MCDILL CODE 560 BLDG. 6, ROOM W-12 G.S.F.C.	X				
	DR. GEORGE LUDWIG C/O IBM ROOM BLDG. 2, ROOM 34 G.S.F.C.		X			
	DR. GEORGE LUDWIG CODE 560 BLDG. 3, ROOM 226 G.S.F.C. * LISTING ONLY			*	X	X
						0054
7	DATA TAPE LIBRARIAN ENRICO FERMI INSTITUTE FOR NUCLEAR STUDIES UNIVERSITY OF CHICAGO 933 EAST 56TH STREET CHICAGO 37, ILLINOIS 60637	X	X	X	X	X

Figure 63-CGO-B data distribution list with addresses

## S-49 (OGO-A) DISTRIBUTION (CON'T.)

EXP. NO.	EXPERIMENTER	DECOM TAPES	ATT/ORB TAPES	COMMAND CARDS	Q. CARD LISTINGS	CHRONO LISTINGS
8	MR. WILLIAM BULGREN PHYSICS DEPARTMENT STATE UNIVERSITY OF IOWA 330 1/2 E. WASHINGTON STREET IOWA CITY, IOWA 52240	X	X	X	X	X
9	DR. J. R. WINKLER SCHOOL OF PHYSICS UNIVERSITY OF MINNESOTA MINNEAPOLIS, MINNESOTA 55455 * LOW DENSITY	X	*	X	X	X
10	MR. ROBERT E. HOLZER INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS LOS ANGELES LABORATORIES UNIV. OF CALIF. AT LOS ANGELES LOS ANGELES, CALIFORNIA 90024	X	X	X	X	X
10A	MR. FRANK GREER CODE 564 BLDG. 14, ROOM N-88 G.S.F.C. * LISTING ONLY	X		*	X	
11	DR. J. HEPPNER CODE 613 BLDG. 21, ROOM G-52 G.S.F.C.	X	X	X	X	X
						0048

EXP. NO.	EXPERIMENTER	DECOM TAPES	ATT/ORB TAPES	COMMAND CARDS	Q. CARD LISTINGS	CHRONO LISTINGS
12	DR. RITA SAGALYN AIR FORCE CAMBRIDGE RESEARCH LABORATORY GEOPHYSICS RESEARCH DIRECTORATE LAWRENCE G. HANSFOM FIELD BEDFORD, MASSACHUSETTS 01731	X	X	X	X	X
13	MR. JOHN SCHMIDT CODE 564 BLDG. 17, ROOM 42 G.S.F.C. * LISTING ONLY	X		*	X	X
14	MR. R. G. MERRILL SECTION 540.40 ITSA/ESSA BOULDER, COLORADO 80302		X			

Figure 63 (Continued)-OGO-B data distribution list with addresses

## S-49 (OGO-A) DISTRIBUTION (CON'T.)

EXP. NO.	EXPERIMENTER	DECOM TAPES	ATT/ORB TAPES	COMMAND CARDS	Q. CARD LISTINGS	CHRONO LISTINGS
15	MR. HOWARD STAGNER CODE 564 BLDG. 17, ROOM 42 G.S.F.C. * LISTING ONLY ** 2 COPIES					
16	MRS. JOAN STOCKWELL CODE 564 BLDG. 17, ROOM 42 G.S.F.C.	X		*	** X	** X
	MR. C. MCCracken CODE 613 BLDG. 4, ROOM 166 G.S.F.C.					
17	MR. L. H. RORDEN BUILDING 308A STANFORD RESEARCH INSTITUTE MENLO PARK, CALIFORNIA 94025	X	X	X	X	X
0052						
18	MR. W. J. LINDSAY 905 PHYSICS-ASTRONOMY BLDG. THE UNIVERSITY OF MICHIGAN ANN ARBOR, MICHIGAN 48104	X	X	X	X	X
19	DR. P. W. MANGE NAVAL RESEARCH LABORATORY CODE 7121 WASHINGTON, D.C. 20390	X	X	X	X	X
20	MR. JOHN QUANN CODE 564 BLDG. 17, ROOM 42 G.S.F.C. * LISTING ONLY	X		*	X	X
21	MR. JOHN QUANN CODE 564 BLDG. 17, ROOM 42 G.S.F.C.	X		X		
	MR. WILFRED E. SCULL CODE 623 BLDG. 5, ROOM C-235 G.S.F.C.				X	X

Figure 63 (Continued)-OGO-B data distribution list with addresses



## S-49 (OGO-A) DISTRIBUTION (CON'T.)

EXP. NO.	EXPERIMENTER	DECOM TAPES	ATT/ORB TAPES	COMMAND CARDS	Q. CARD LISTINGS	CHRONO LISTINGS
	MR. KENNETH KISSEN CODE 623 BLDG. 5, ROOM C-229 G.S.F.C.				X	X
	MR. RONALD BRITTNER CODE 535 BLDG. 14, ROOM N-282 G.S.F.C.				X	X
						0053
	MR. MORT PASTERNAK CODE 564 BLDG. 17, ROOM 30 G.S.F.C.				X	X
	MR. BILL FRITTS CODE 420.07 BLDG. 16, ROOM T4 G.S.F.C.				X	X
	MR. MICHAEL MAHONEY CODE 564 BLDG. 17, ROOM 10 G.S.F.C.				X	X
						0025

Figure 63 (Continued)-OGO-B data distribution list with addresses

Note: The OGO-B distribution will be identical to that for OGO-A with the following exception:  
 EXP 10A - Frank Greer - since we do not except the s/c to spin no duplicate tape will be produced.

## Special Purpose Data Processing

Processing of Special Purpose data for OGO-B is suited to the specific requirements of each of the Special Purpose experimenters. There are two on OGO-B:

4917 Dr. R. A. Helliwell

4911 Dr. J. P. Heppner

4917 will require the use of the analog tape dubbing station which has been established especially to serve those experimenters who require duplicate analog tapes. The specific processing operations for each experimenter is as follows.

Experiment 4917 Dr. R. A. Helliwell  
Stanford University  
Stanford, California

Special Purpose data will be processed onto 10-1/2 inch reels of 1 mil mylar (containing some 3600 ft of tape). Recording will be done at 7-1/2 ips. It is to be noted that the speed of recording at the ground station is at 30 ips.

Track 1 is SP filtered 51.5 to 54.5 Kc downconverted by the 5th harmonic of the 10 Kc reference frequency and passed through a 5 Kc low pass filter.

Track 2 is SP filtered 25-35 Kc discriminated and passed through a 1 Kc low pass filter

Track 3 is SP passed through a 13 Kc low pass filter

Track 4 is Serial Decimal Time

Track 5 is SP filtered 13-35 Kc

Track 6 is WWV and voice

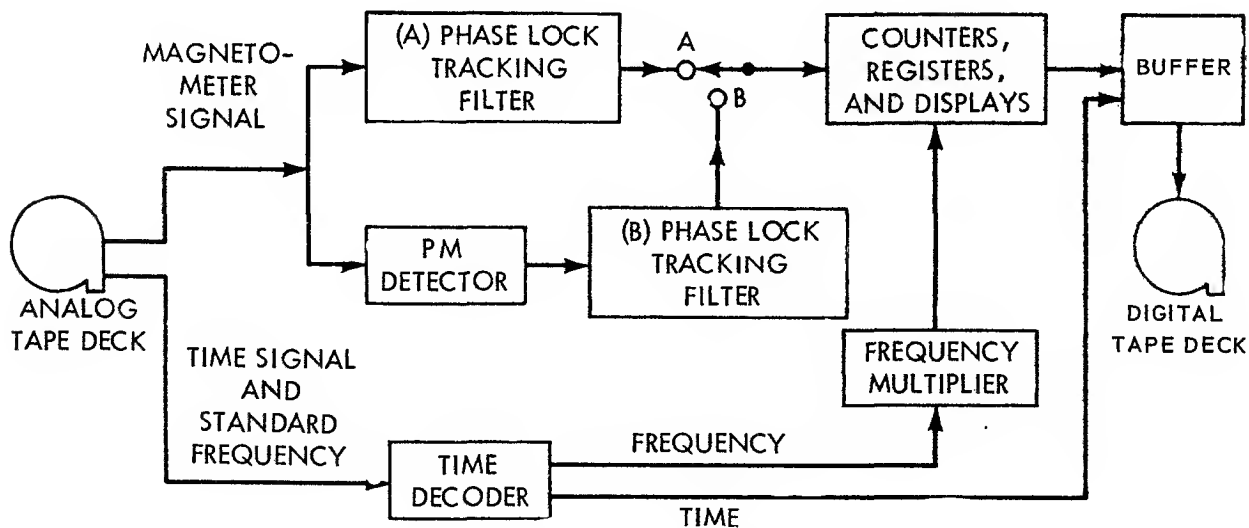
Track 7 is 10 Kc reference.

All tracks are direct except track 2 which is FM and track 4 which is FM with center frequency near 6 Kcs.

A special processing line (see Figure 64) has been set up by the Data Processing Branch to reduce the special purpose rubidium magnetometer data for Experiment 49-11.

The special processor for OGO magnetometer data is outlined in the figure on the following page. The recorded telemetry signal, the ground station time signal, and the station standard frequency are obtained from the reproduce analog tape deck. The station standard frequency will be either 1 kc, 10 kc, or 100 kc. The tape deck can be made to reproduce the signals at either 1, 2, 4, 8, or 16 times the recorded speed.

When processing the direct magnetometer signal (channel No. 1), the "A" phase lock tracking filter is locked to the noisy magnetometer telemetry signal, and the output of the tracking filter is a relatively clean signal which is phase locked to the magnetometer signal. The frequency of this clean signal is measured in the Counter unit. The frequency is determined by measuring the number of cycles of the signal in a period of time, which can be selected by means of a set of switches on the control panel. The range of selection is 1 millisecond to 9.999 seconds. The standard frequency, extracted from the analog tape signal by a time decoder, is multiplied to 5 mc to be used for the timing in the frequency



Orbiting Geophysical Observatories Magnetometer Special Data Processor

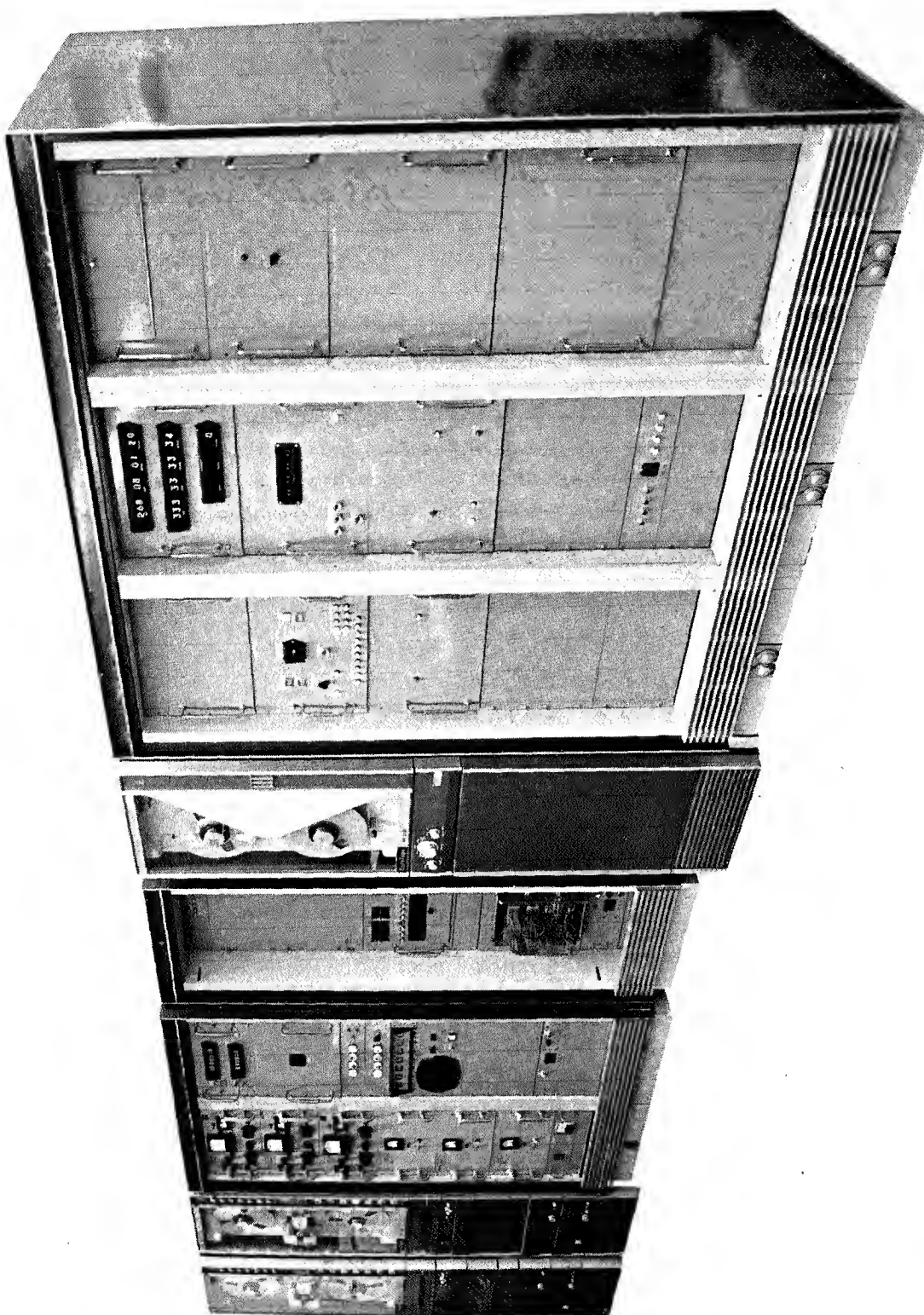


Figure 64--Experiment 4911 Rubidium Magnetometer Processing Line

measuring unit. By using this recorded standard frequency in this manner, compensation is obtained for effects of tape recorded wow and flutter. Specifically, a counter is started counting cycles of the multiplied standard frequency at a zero crossing of the tracking filter reproduction of the magnetometer signal. The counter is turned off at the second integral signal cycle after the preset time is reached. The number of signal cycles in this period is also counted. The ratio of these two counts gives the frequency of the magnetometer signal. At the shortest time period, the resolution is limited to one cycle of the 5 mc timing waveform, or 1 part in 5000. At the longest period, the resolution is approximately 1 part in  $5 \times 10^7$ .

When processing the channel No. 2 signal consisting of the subcarrier modulated with the magnetometer signal, the subcarrier is demodulated in the phase-locked PM detector. The resulting noisy low frequency magnetometer signal is fed into the "B" phase lock tracking filter. The output of the tracking filter is sent to the frequency measuring counters through switch position B. The magnetometer frequency data from the counter registers are put into the buffer where they are merged with ground station time from the time decoder and written on a digital tape in computer format. The time decoder, buffer, and digital tape unit are identical to those in the OGO PCM data processor and serve similar functions in the special magnetometer processor.

The digital buffer tape is next processed on the IBM 7010 computer where the data is edited, monitored for quality, and reformatted. The computer prints a quality listing, and writes the data on an edit tape in the IBM-compatible Moonlight Format. The quality listing and edit tape are then forwarded to the experimenter group.

#### Chronological Listing

A chronological listing of special purpose analog tapes, similar to those developed for PCM data, is printed on a monthly cumulative basis on the computer. The listing indicates the extent of processing rendered on all incoming ground station special purpose analog tapes. It is distributed to all Special Purpose experimenters, to the Project Scientist, and to the OGO Project.

#### Spacecraft Commands

As the Special Purpose analog tapes received from the ground stations contain spacecraft commands recorded at the station, in the manner of PCM analog tapes, the Special Purpose tapes can and will be used for obtaining spacecraft commands when the PCM analog tape command tracks are not available for this use.

#### Tape Disposition

Final output tapes from the Special Purpose processing operations will be sent to the addressees listed for those experimenters in the PCM data tape disposition list, Section III A.

#### IV. PROCESSING OPERATIONS

OGO-B data processing operations make use of the systems described in the preceding sections. The operations themselves are sustained by the workings of A/D, Production Control, and Quality Control Groups, and are configured by the mission being carried out. Launch back-up operations, real-time Quick Look passes, and normal production processing each shape the operation somewhat differently. These aspects are described below.

##### PRODUCTION CONTROL OPERATIONS

###### Scheduling

Production Control (PC) is responsible for ensuring that data are processed in chronological order in three phases of the data-processing operation: analog-to-digital conversion, quality control and edit, and decommutation.

The only exception to the chronological processing will be the data from the first 2 weeks after launch. These passes will be processed as received and sent as soon as possible to the experimenters.

After the satellite has been in orbit one month, the chronological processing of all passes will begin. Those original files from the first two weeks of post-launch operations will be processed again starting with the editing. Attitude computation using Housekeeping data also will take place one month after launch using the orbital data available at the time the attitude determination program is run.

Analog-to-Digital Conversion – Buffer tapes produced by the analog-to-digital conversion processing line must be chronological by station. To meet this requirement, Production Control will prepare for the processing-line operators a list of analog tapes to be processed on a particular day. To assure that all passes recorded have been received, Production Control will compare the station-by-station chronological file maintained by the analog tape library with cumulative telemetry reports received from the ground stations. All buffer tapes will be numbered consecutively throughout the life of the satellite.

Quality Control and Edit – The buffer tapes, each being chronological by station, should next be scheduled by PC to undergo computer quality-control checking and editing. The edit tapes are to be chronological by time. A regular number of files constitutes a computer run for quality-control checking and editing; at least one run shall be made every week, such that a minimum backlog

is kept. In this phase of the data processing, PC must assure that, starting with the oldest unedited file and continuing through the number of files desired in each run, all files recorded at the ground stations have been digitized.

Decommutation – Production Control will schedule decommutation runs on the computer. The decommutation runs, will be scheduled every week. The edit tapes must be in chronological order for input to the decommutation program. Those edit tapes made from redigitized files (i.e., files rejected by the quality control program in an earlier run but later edited successfully) must be placed in proper sequence. The decommutation output card is shown in Figure 57.

#### Attitude Orbit Computation

Production Control will have the responsibility of the running of the Attitude-Orbit Program and the duping of the output tapes for all the OGO experimenters. Copies of the listings generated during a run should be burst and bound with copies forwarded to Quality Control and the Data Processing Engineer.

#### Functions of the Quality Control Group

The Quality Control Group shall have the responsibility of assuring that the tapes produced for the experimenters by the Data Processing Branch contain the proper information. To accomplish this, Quality Control must check the data tapes and listings produced during the computer operations. This includes the following:

- (a) verification that the data files processed were in chronological order
- (b) there existed no overlap of time nor were redundant data files processed
- (c) determination of whether a faulty file should be reprocessed or deleted
- (d) verification of time accuracy on all data tapes
- (e) checking the listing generated by the Attitude-Orbit program for validity.

Other functions include:

- (a) Processing of command cards and the preparation of command listings and tapes
- (b) reformatting, listing and analysis of quality cards
- (c) performing statistical analysis of S/C data performance, A/D and ground station data recovery performance.

Final approval as to whether experimenter data tapes and attitude-orbit tapes are to be shipped to experimenters must come through Quality Control.

### Tape Evaluation

Analog tapes received from the data acquisition stations are evaluated for quality and use of approved recording techniques. Tapes are analyzed by data inspectors who compare them to established standards. Findings are summarized in weekly reports, which are used by the Network Operations Branch to check the efficiency of station equipment and station operator performance.

### Modes of Operation

Six basic modes of operation will be employed for OGO-B: Real-time OGO Launch Support extending from launch to launch plus one week, Quick Look Processing for the first two weeks after launch, OGO Quick Look Processing for real time data tapes, Normal Production Processing for Playback Data Tapes, and Special Purpose Telemetry Processing. Flow-charts for each operation (Figures 65-71) indicate the requirements for all and the subtle differences distinguishing each.

Real Time OGO Launch Support (Figure 65) is intended as a supplement to the OGO Control Center during launch operations, and as a prime backup during this period in case the Control Center goes down. The more salient features of this operational mode are the processing of data arriving in real-time via OGO control Center from the Rosman and Ulaska ground station data links, the omission of precision time-correction functions to enhance processing speed, and the elaborate spacecraft subsystems data processing loop designed for direct support of Control Center operations.

OGO Quick Look Processing for the first two weeks after launch (Figure 66) differs chiefly in that processing of data will be rendered upon incoming ground station analog tapes on a rapid semi-chronological bases, i.e., chronological per decomm tape. These will be given a partial time correction only, edited, decommutated and shipped to experimenters as rapidly as possible. Later this data will be reprocessed in chronological order and given a complete time correction.

OGO Quick Look Processing conducted routinely after launch once or twice per week (Figure 67) is intended to give experimenters a quick look in detail of their experiment as it operates during normal satellite operations. The data will be received via data links thru OGO Control Center from the Rosman and/or



Ulaska stations. Real time data will be digitized, edited, decommutated and shipped to experimenters without time-corrections within 48 hours. Playback data will be processed, time corrected to an accuracy of  $< 864$  ms and dispatched to experimenters within 5 working days. All data will later be processed chronologically in the routine manner when the ground station tapes are received.

Normal Production for real time data and for Playback data will consist of the complete production processing and time-correction cycles as earlier described. It will differ for real-time and playback data processing to the extent required by playback reformatting and time-correction, as shown in the processing flow charts in Figures 68 and 69.

Special Purpose Telemetry Processing will occur as earlier described and as indicated in the processing flow chart of Figure 70. During spacecraft Quick Look passes over the Rosman and Ulaska ground stations, expected to occur once or twice per week, Experiment 49-11 Rubidium Magnetometer data will be received and processed in real-time as received over the data links via the OGO Control Center.

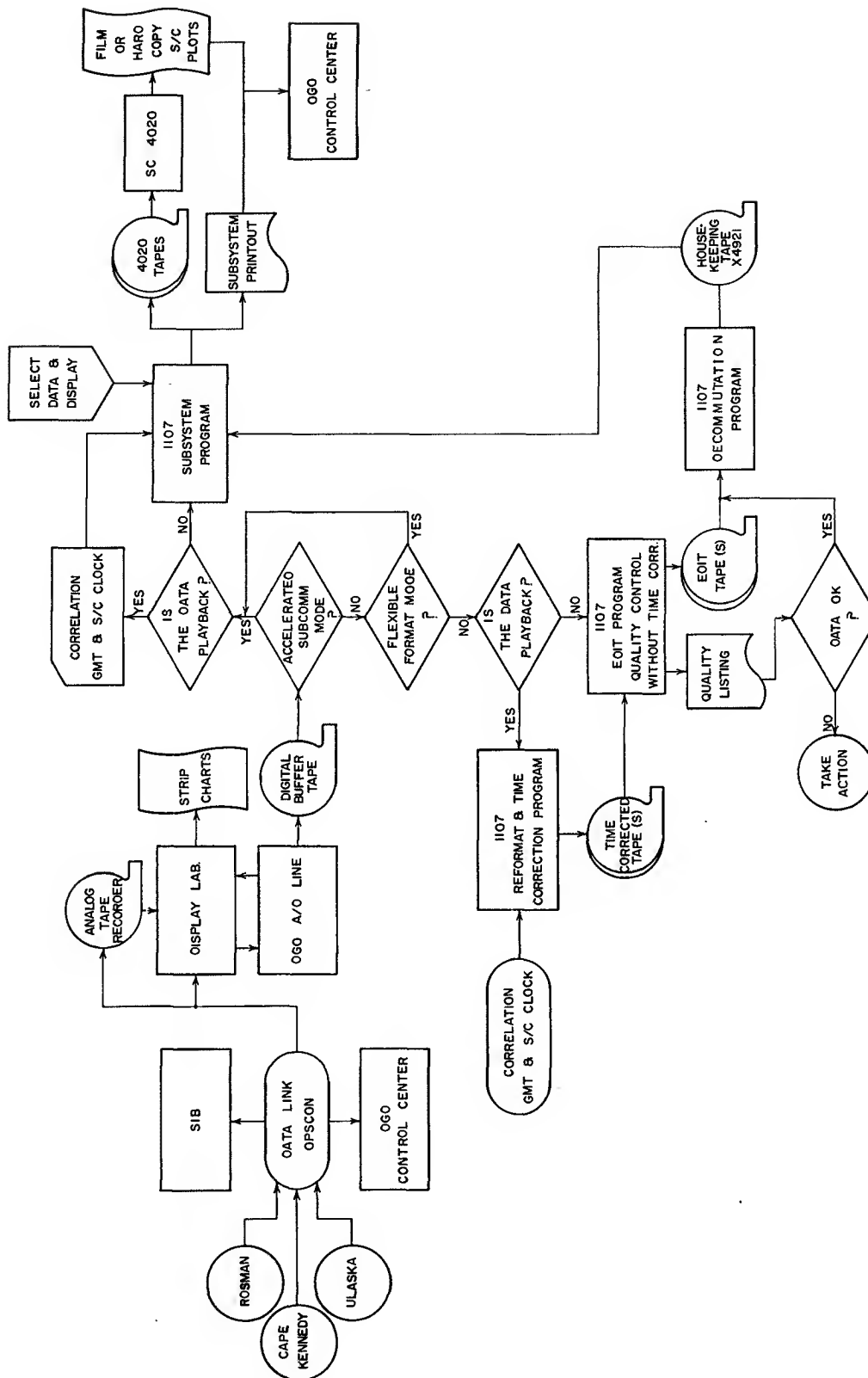


Figure 65-Real Time OGO Launch Support Launch to Launch + 1 week

Figure 66--OGO Quick Look Processing First 2 weeks of Data after Launch

OGO QUICK LOOK PROCESSING (ONCE / TWICE PER WEEK)

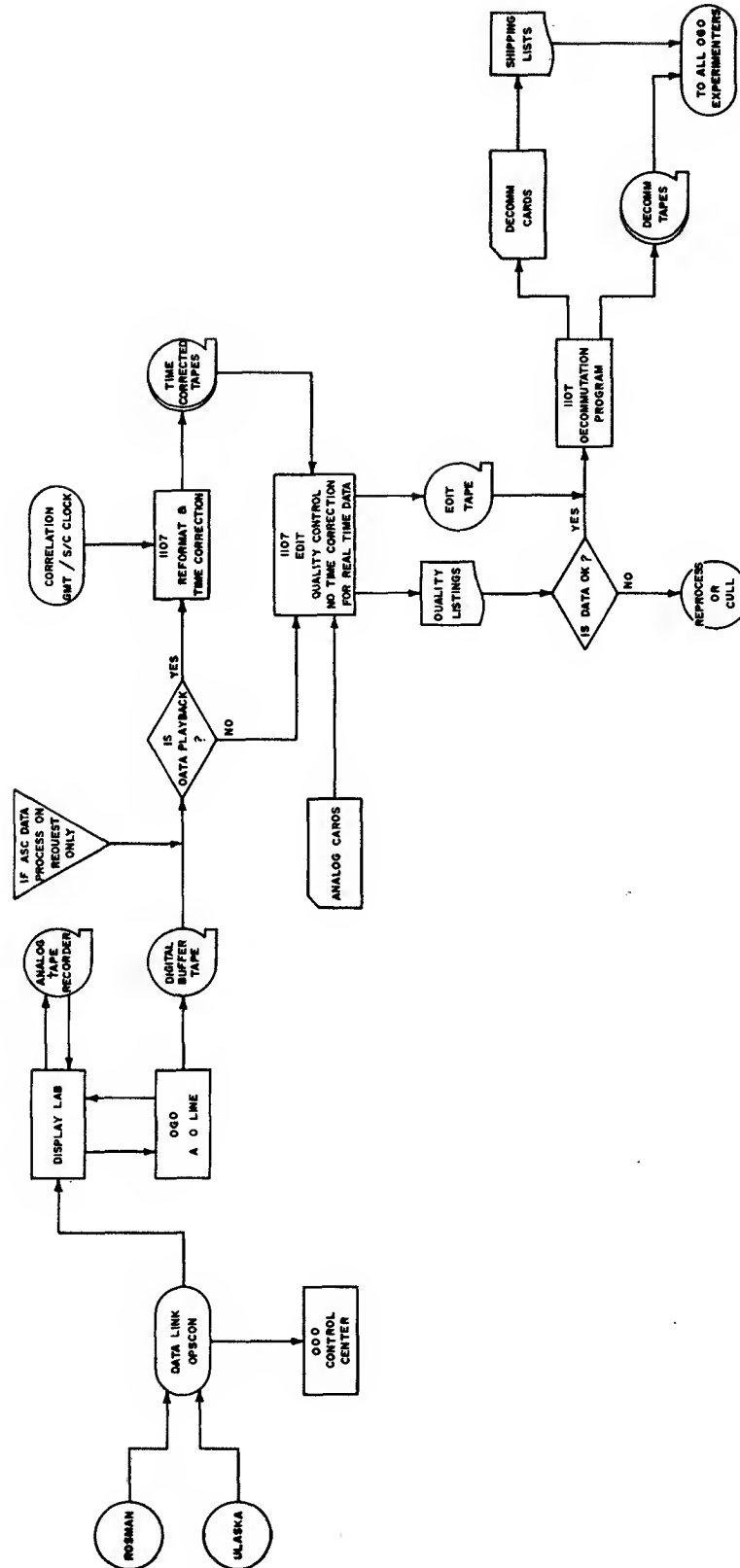


Figure 67-OGO Quick Look Processing (Once/Twice per week)

[illegible]

50

# OGO PLAYBACK DATA-NORMAL PRODUCTION

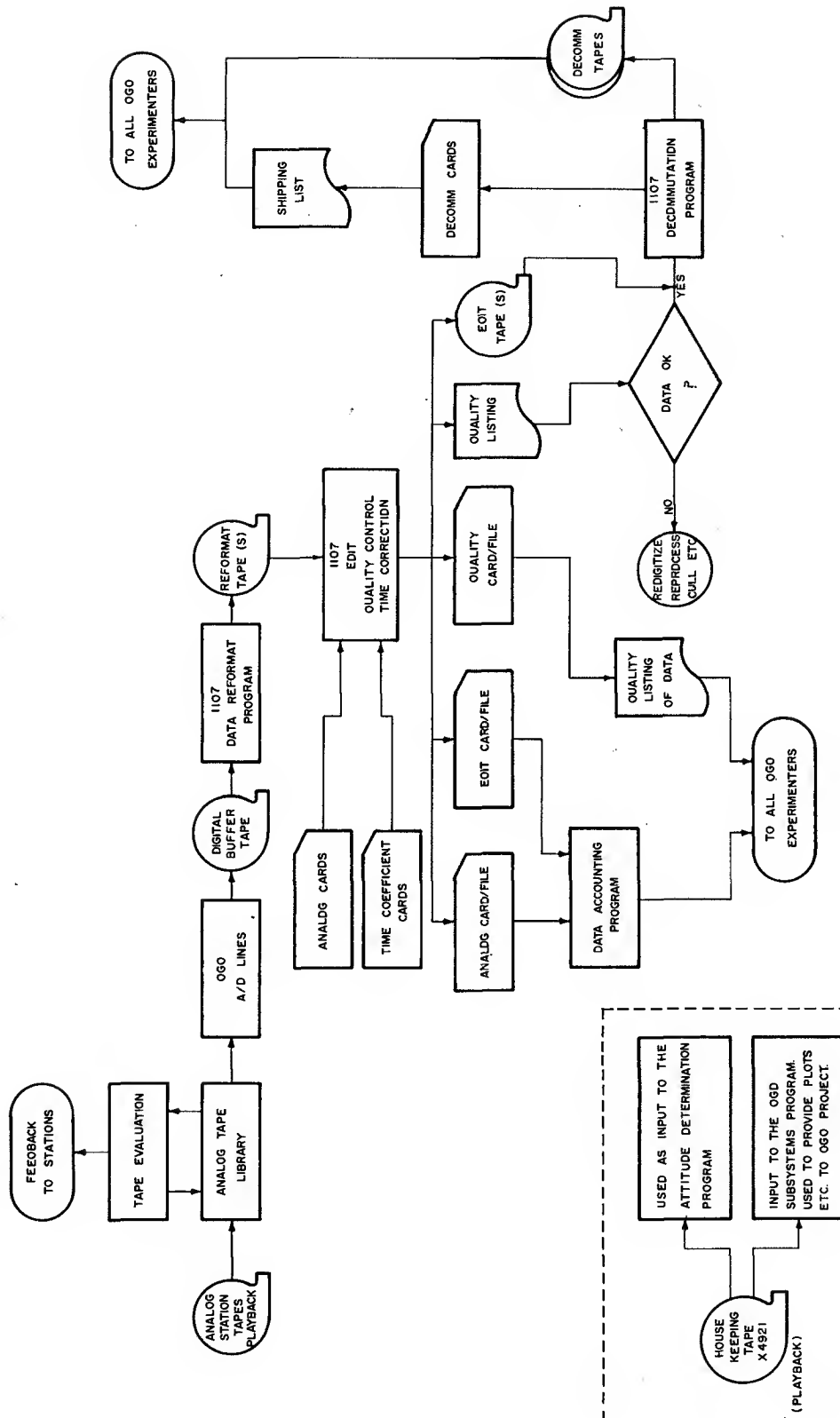


Figure 69-OGO Playback data Normal Production

# SPECIAL PURPOSE TELEMETRY PROCESSING

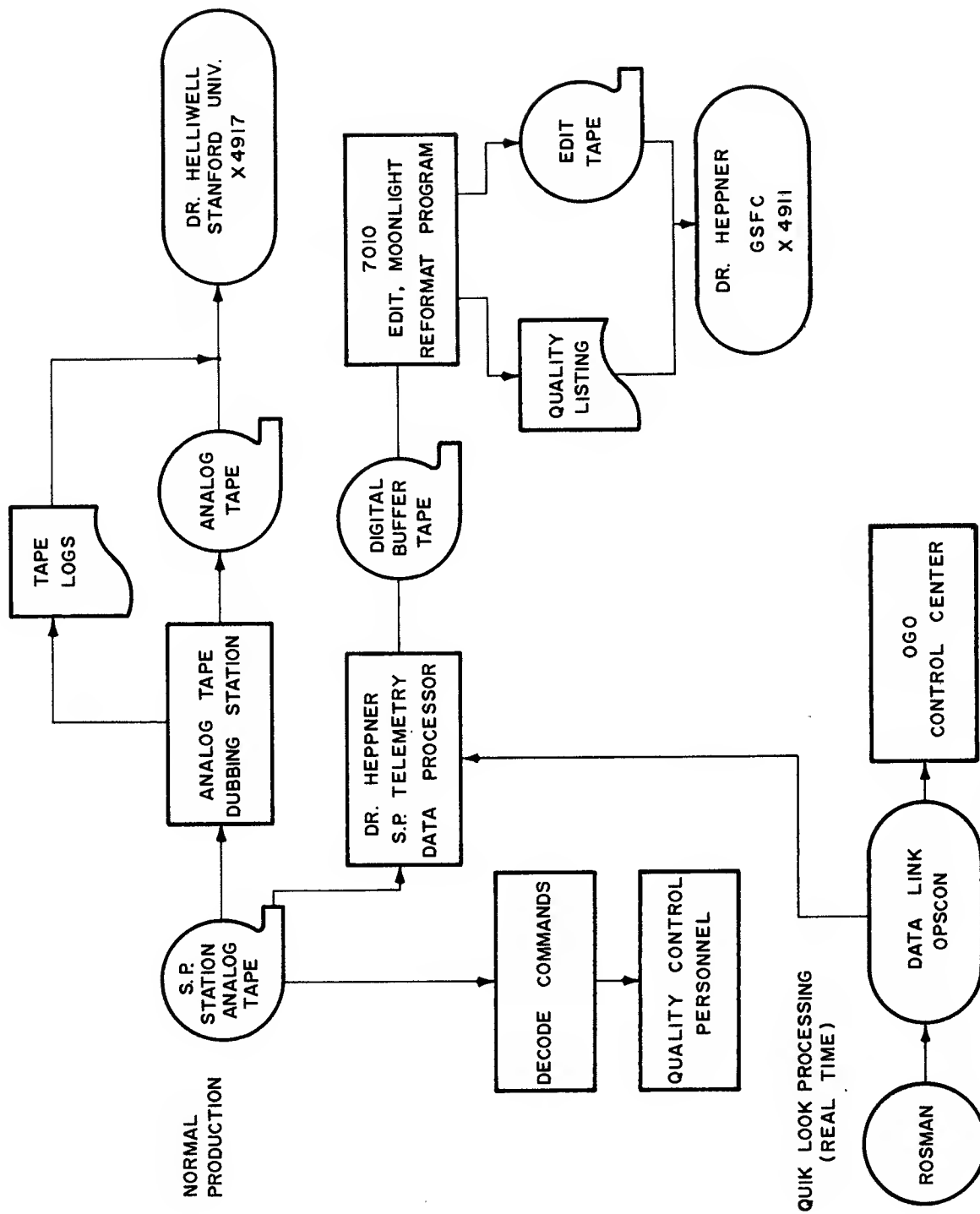


Figure 70--Special Purpose Telemetry Processing

# ATTITUDE-ORBIT PROCESSING

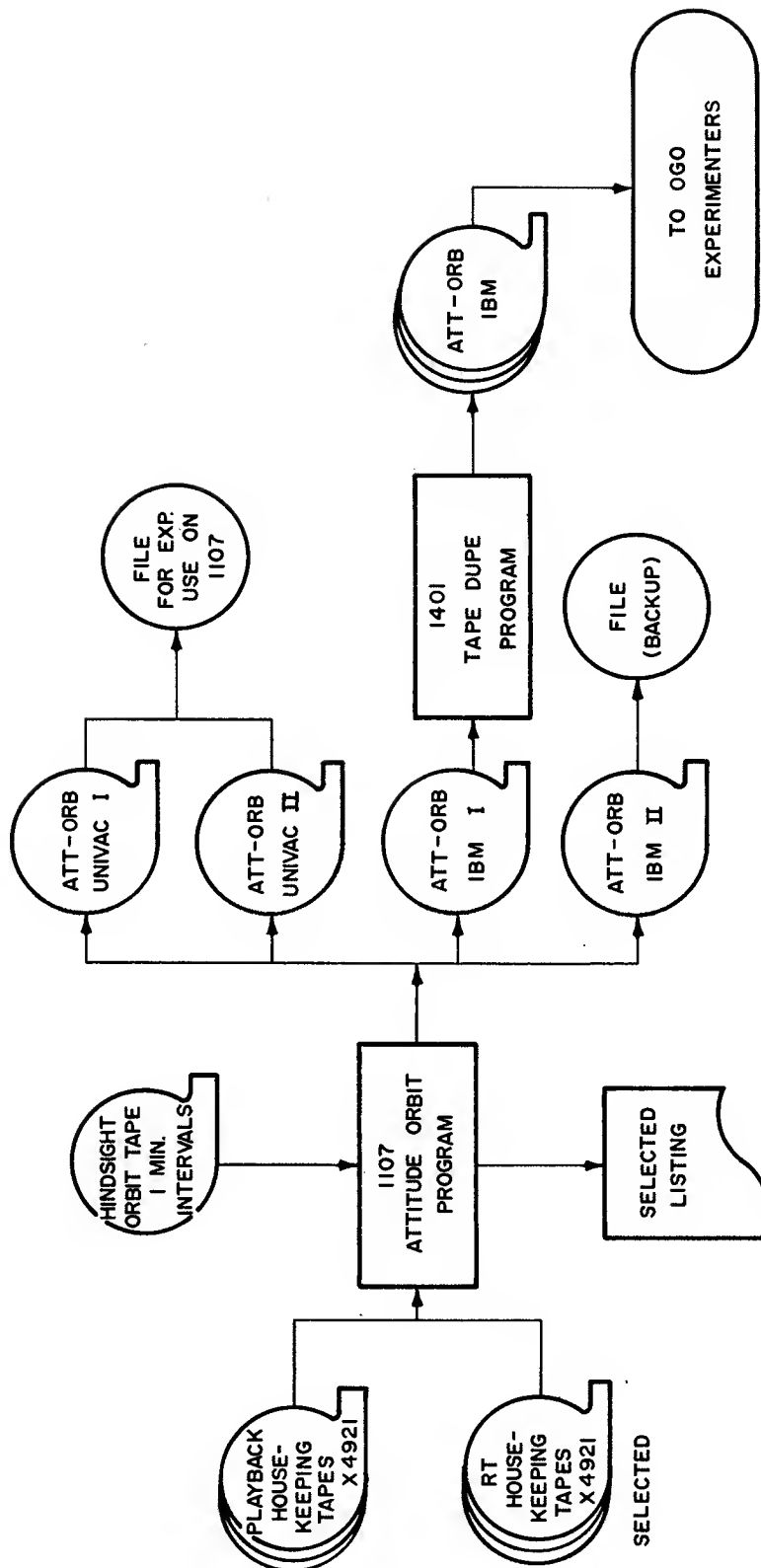


Figure 71-Attitude-Orbit Processing



OCT 16 HOUR 22 MIN 4 SEC 56.177 DAYR 289 MSDA 7949616D

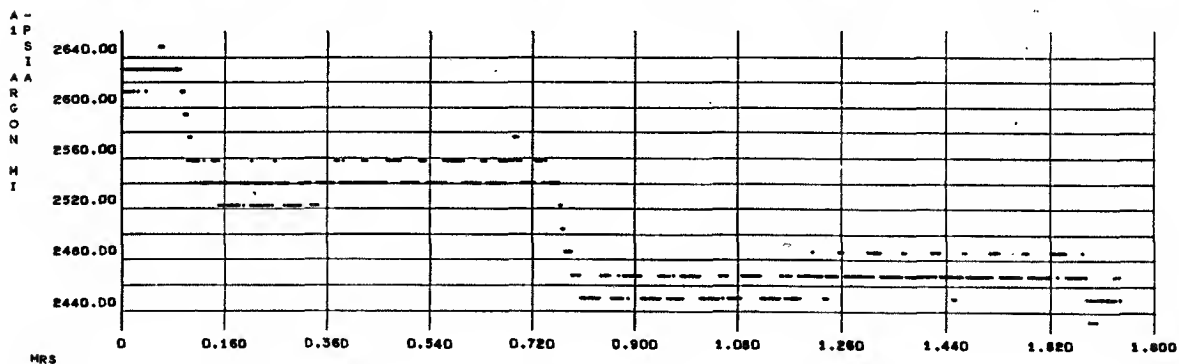
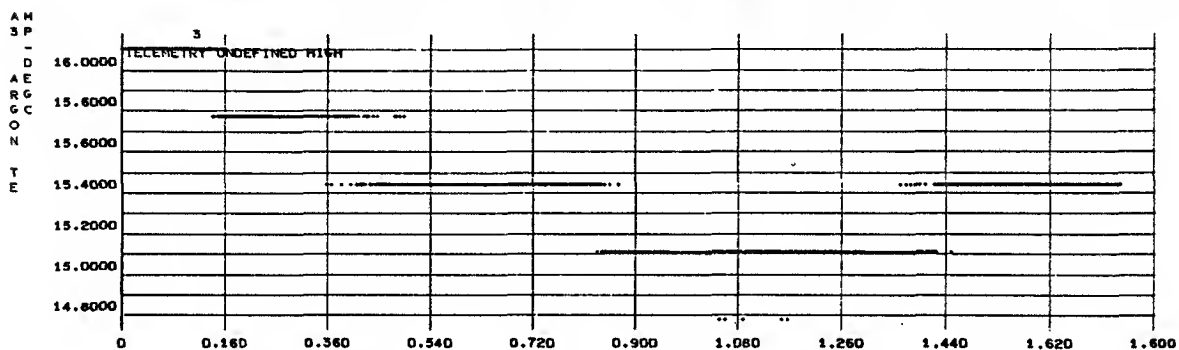
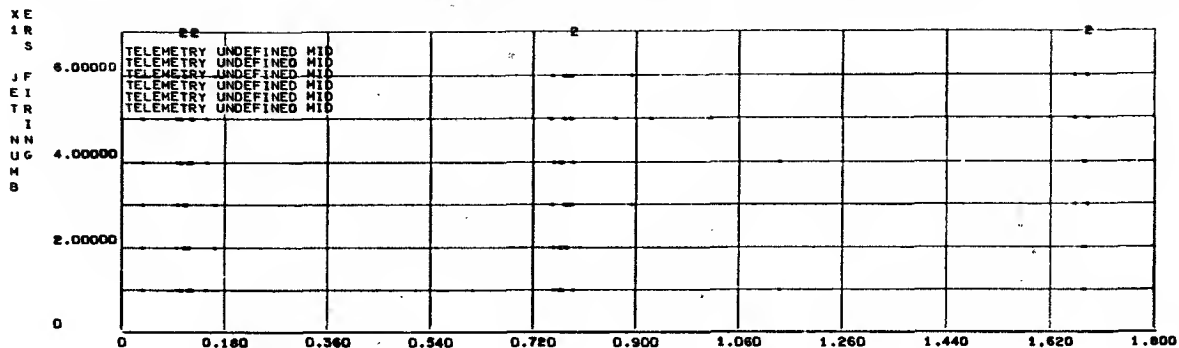


Figure 72A-OGO ACS Subsystem Plots

ARRAY ANGLE AND DRIVE MOTOR

POGO S-50 DECOH PRINTOUTS

U1107/SC4020  
0000 0014

OCT 16 HOUR 22 MIN 4 SEC 56.177 DAYR 289 MSDA 79496180

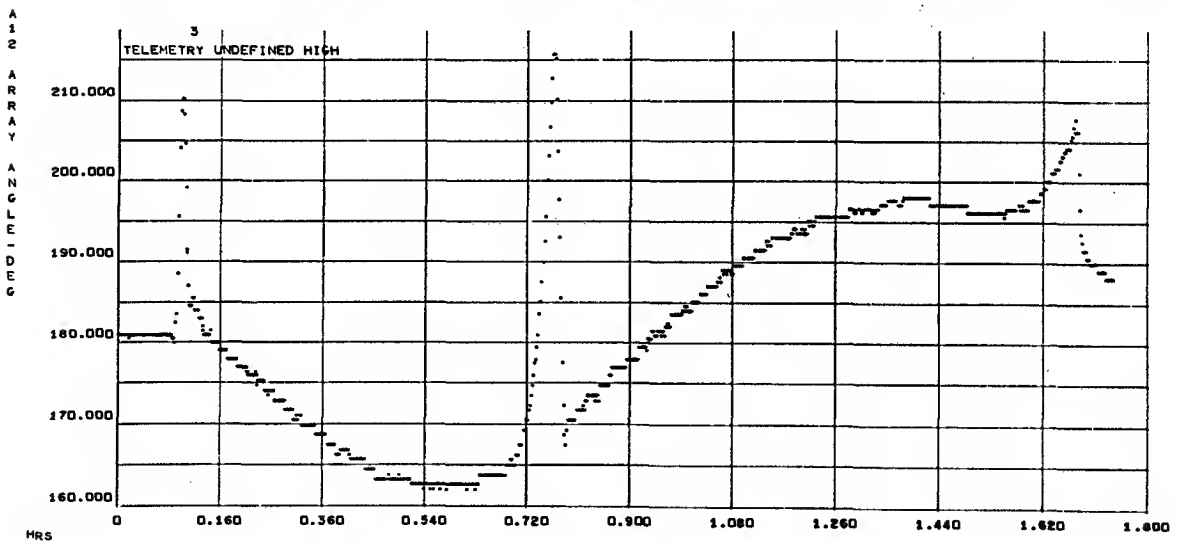
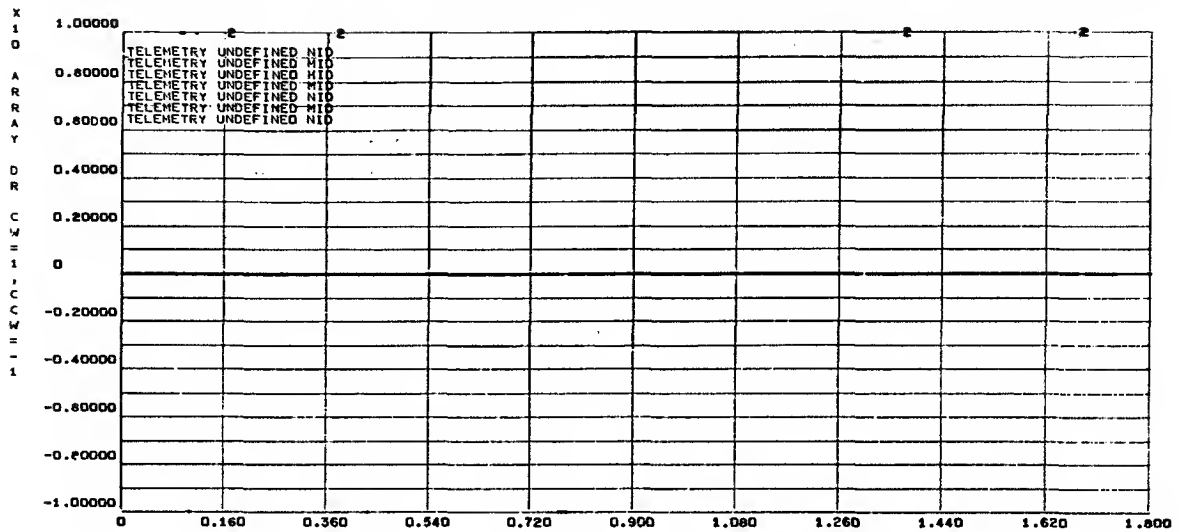


Figure 72B-OGO ACS Subsystem Plots

ROLL TACHOMETER STATUS

POGO S-50 DECON PRINTOUTS

U1167/SC4620  
0000 0010

OCT 16 HOUR 22 MIN 4 SEC 56.177 DAYR 289 MSDA 79496180

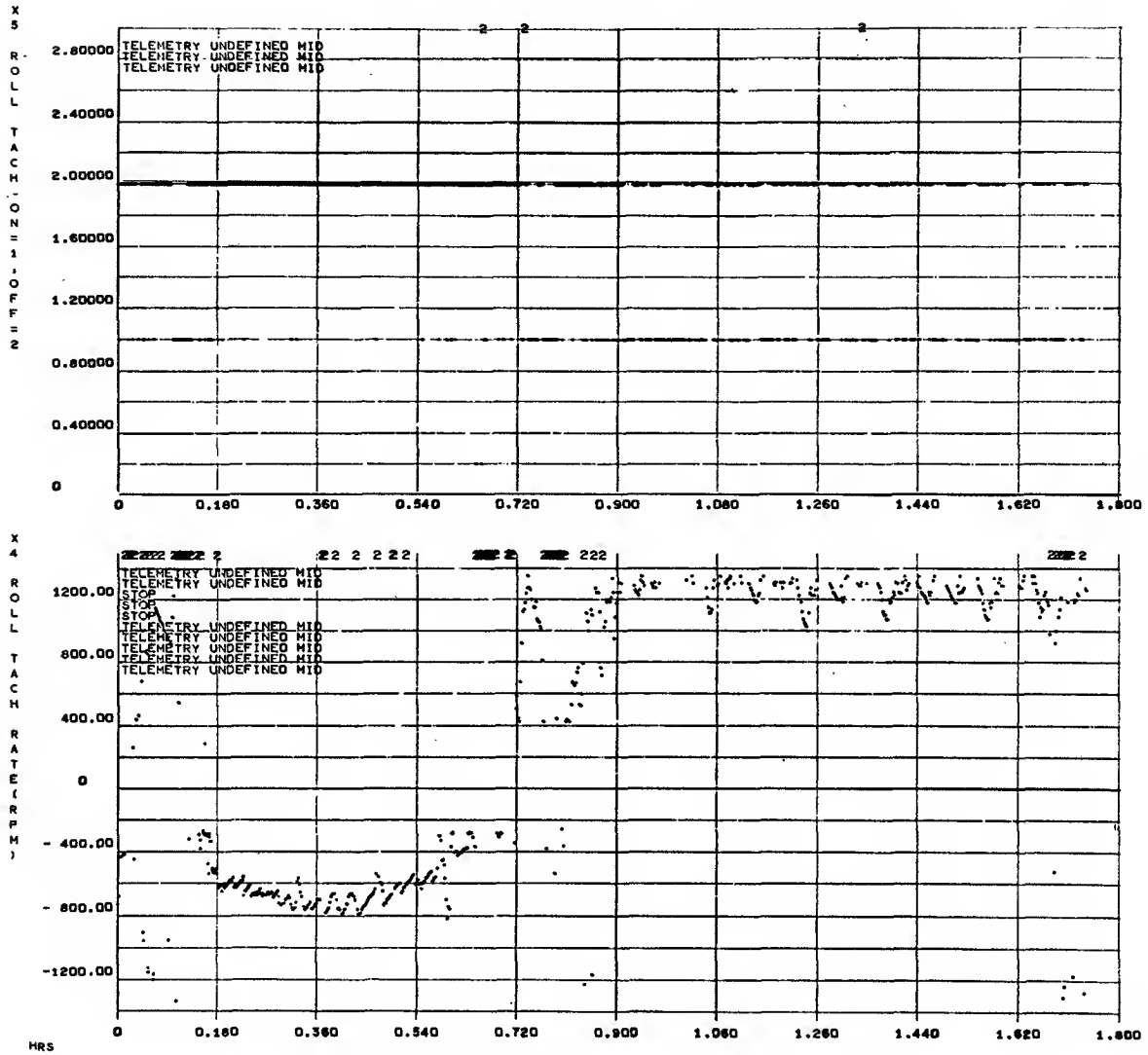


Figure 72C-OGO ACS Subsystem Plots

AW ERROR-DEG

POGO S-50 DECOM PRINTOUTS

U1107/5C4020  
0000 0000

OCT 10 HOUR 22 MIN 4 SEC 56.177 DAYR 289 HSDA 79490100

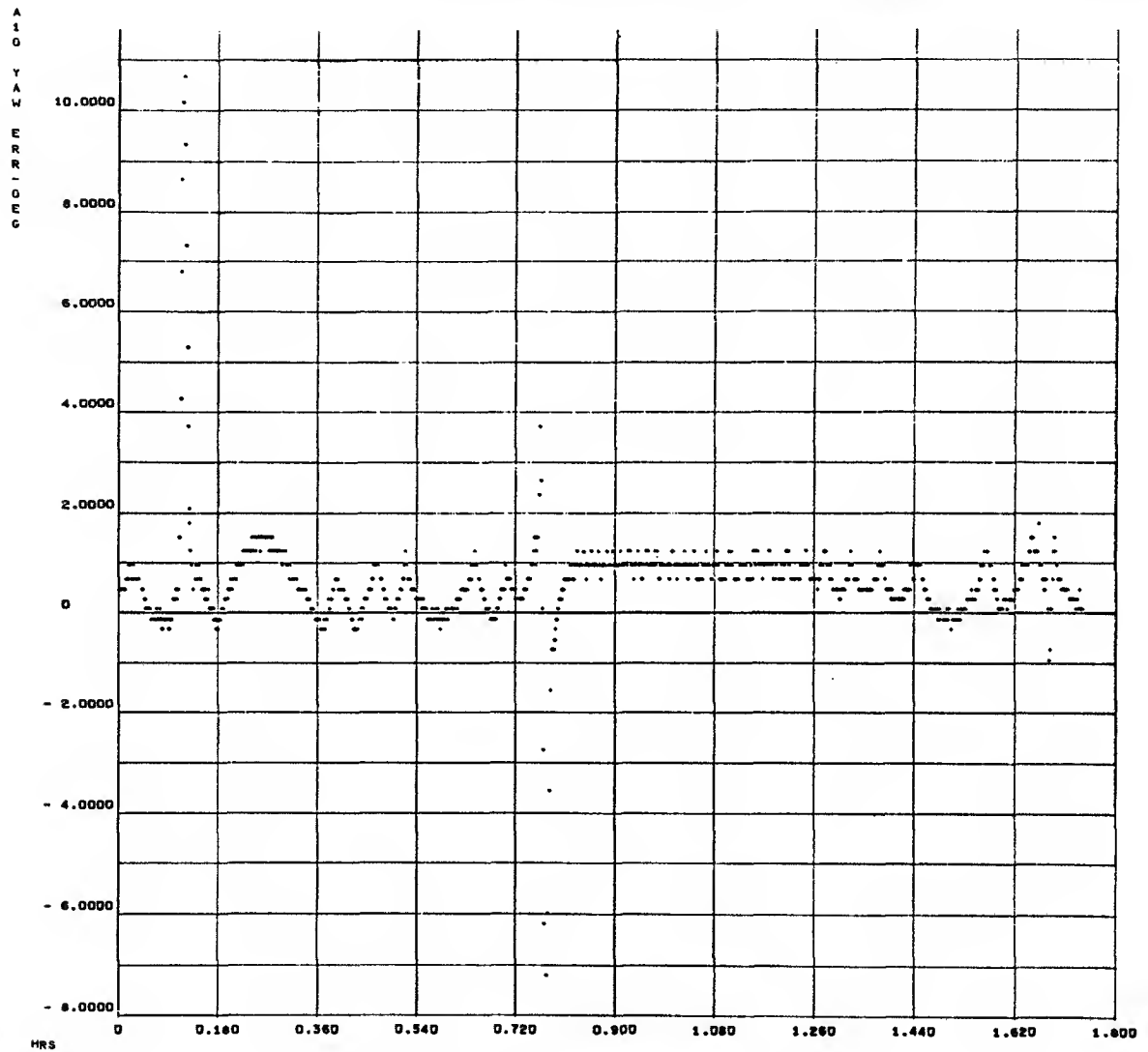


Figure 72D-OGO ACS Subsystem Plots

ITCH ERROR-DEG

POGO S-50 DECOM PRINTOUTS

U1107/SC4020  
0000 0005

OCT 16 HOUR 22 MIN 4 SEC 56.177 DAYR 289 MSDA 79496180

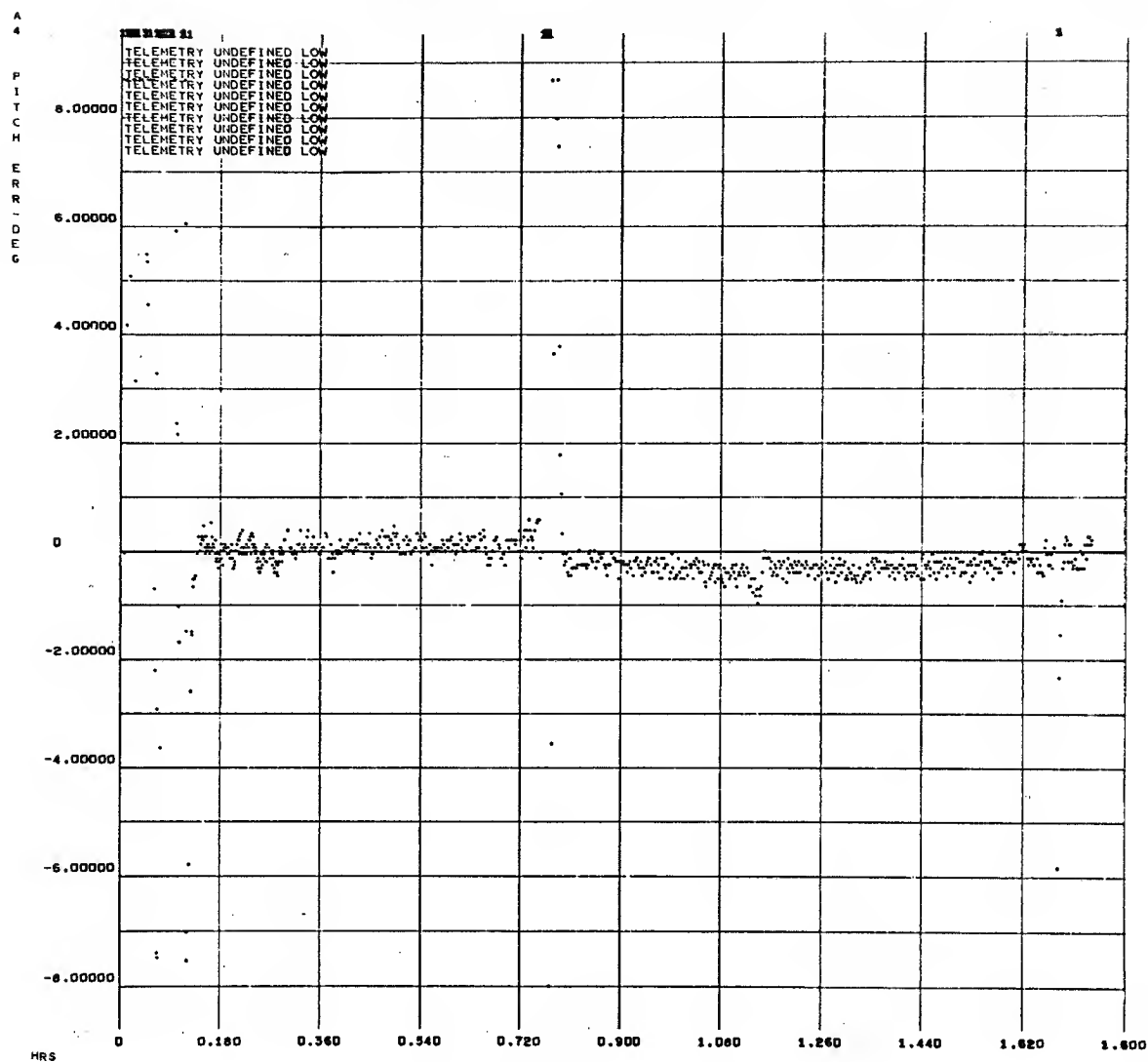


Figure 72E-OGO ACS Subsystem Plots

YAW ERROR-DEG

POGO S-50 DECOM PRINTOUTS

U1107/SC4020  
0000 0000

OCT 16 HOUR 22 MIN 4 SEC 56.17T DAYR 289 MSDA 79496180

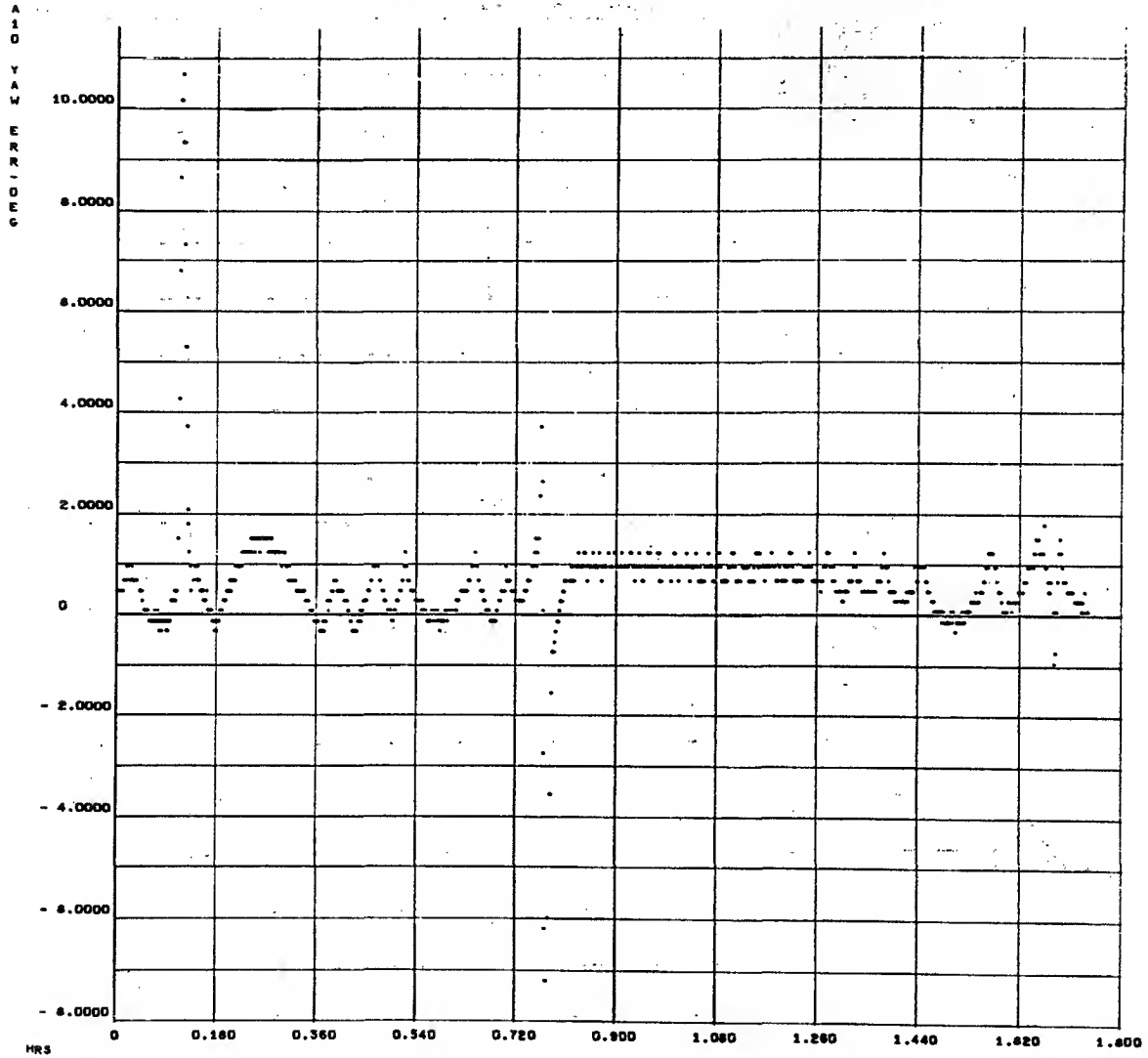


Figure 72F-OGO ACS Subsystem Plots

ROLL ERROR-DEG

POGO S-50 DECOM PRINTOUTS

U1107/5C4020  
0000 0006

OCT 16 HOUR 22 MIN 4 SEC 56.177 DAYR 289 HSDA 79496180

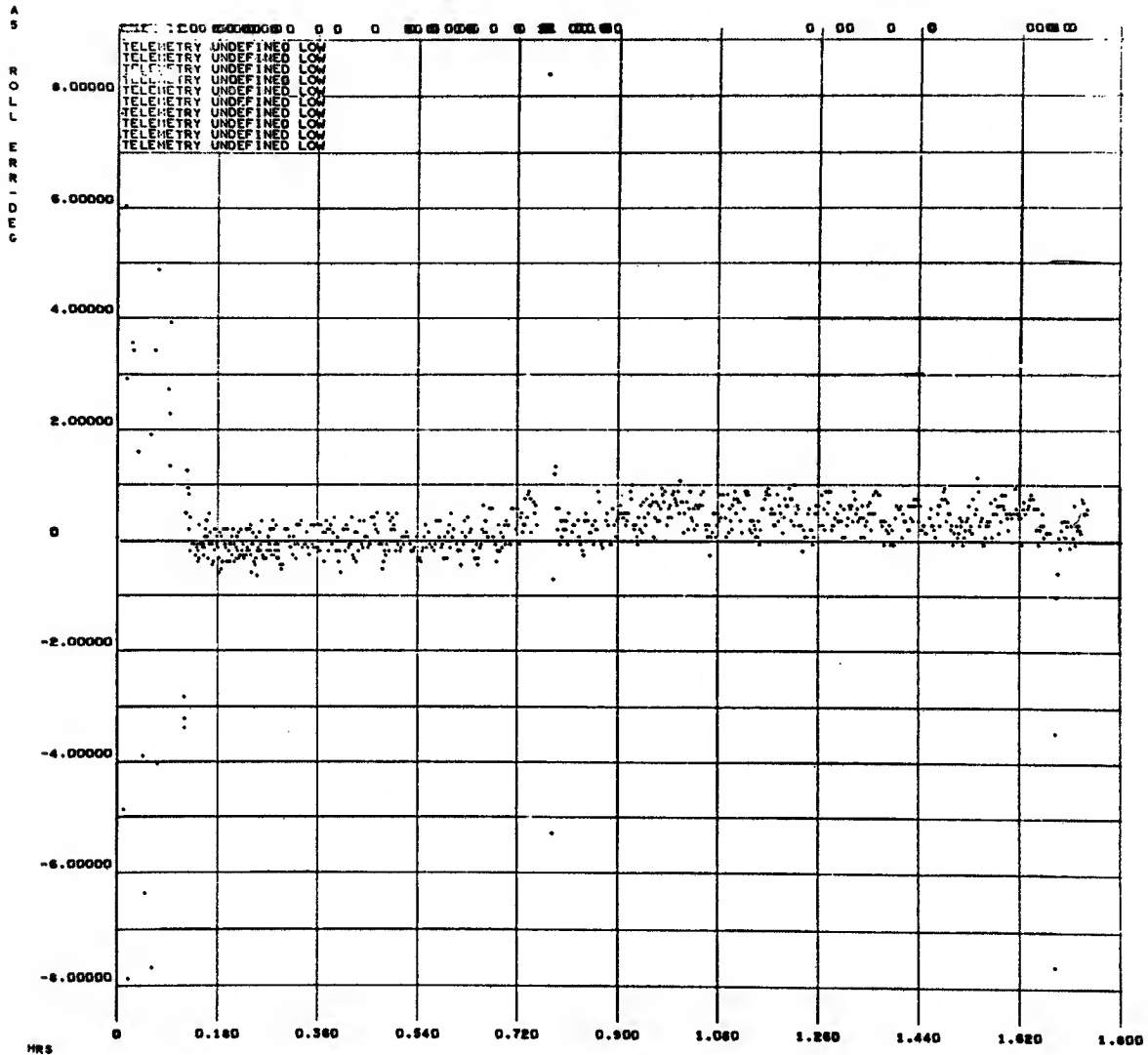


Figure 72G-OGO ACS Subsystem Plots